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### THE INDEPENDENT TELEPHONE CONVENTION.

The meeting this week at Cleveland of the Independent Telephone Convention again brings to notice the great proportions to which the independent movement has grown, particularly in the West, which section, in fact, may thus far be considered its main field of action. At the first meeting of the association, three years ago, though the movement had already attained great strength, there was little cohesion, and the present solidarity can be largely attributed to the fostering influences of the national and several State telephone organizations; their banded strength inspiring confidence where otherwise timidity of action in the face of a colossal rival would be natural. As in the case of the older associations during the first years of their existence, the meetings of the Independent Telephone Association have thus far had their principal value in the occasion afforded for extending acquaintance and in the personal exchange of opinion, the papers read being somewhat hap-hazard in subject. As time goes by, however, the Independent Telephone Convention will doubtless develop in its technical educational features, and thus perform the same service for the art of telephony that the electric light and street railway conventions do for the arts which they respectively represent.

### AUTOMOBILE CHARGING STATIONS.

Those who have not had experience in such work are almost invariably astonished at the difficulties involved in developing a system of operation for an automobile charging station, and the pandemonium which quickly reigns in such a station if every detail of operation is not carefully studied and systematized. At first sight it would appear that it should be no more difficult to care for one hundred electric vehicles than for one hundred horse-driven vehicles. The batteries cannot be expected to call for much more attention and trouble than the equivalent number of horses, and it might therefore be expected that an automobile station could be as easily started and as smoothly run as a livery stable having the same number of vehicles. If, however, mankind had had no experience with horses and the attempt should suddenly be made to operate a large stable with the new and untried system of horse propulsion, even greater difficulties would undoubtedly be experienced than have been found in automobile stations, since it is the familiarity with the needs and troubles of horses and the methods of caring for them gained in scores and hundreds of years that renders the care of large numbers of horses so simple. With automobiles, the necessary care and maintenance of every detail is largely an unknown factor that must be tried before proper provisions can be made. The inspection of running gears, repairs of tires, renewals of battery plates, and all the other elements of maintenance that must be carried out with great care in such complex and unperfected mechanisms as automobiles to keep them in ship-shape order, must all be worked out by the first few operating companies. There is given on another page an account of some of the work and experience of the New England Electric Vehicle Transportation Company in this line.

### GROUNDING THE NEUTRAL IN THREE-WIRE SYSTEMS.

A report of the National Electric Light Association on grounding circuits is interesting and important. For years a difference of opinion has existed between Fire Underwriters and electrical engineers; and also between electrical engineers themselves, as to the advisability of permanently grounding the neutral conductor of

Edison three-wire systems. The fact is, that the neutral conductor of an Edison three-wire system grounds itself automatically in a more or less complete fashion as soon as the system acquires considerable magnitude, so that the question becomes academic in character, in view of the condition which confronts station managers.

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The underwriters for a long time insisted upon insulation, even when insulation became a matter of physical impossibility. The station managers pointed to the fact that the permanent grounding of a neutral conductor reduced fire hazard by limiting the pressure at an accidental ground to 115 volts, instead of making it occasionally 230 volts. They also pointed to the fact that with the permanently-grounded neutral, if any injury to insulation was done accidentally, as by running a nail into wire moulding and grounding the wire therein, whatever damage might follow such grounding would take place upon the instant, and when the perpetrator of the mischief would be present to observe the effect and prevent an outbreak of fire; whereas, if the system were otherwise insulated, no effect would be produced by the grounding until perhaps a heavy ground occurred, say in the middle of the night, on the opposite side of the system, thereby bringing 200 volts and a possibly powerful current into the leak at a time when no one might be present to avert accident.

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We are glad to see that the National Electric Light Association committee has finally reported in favor of grounding the neutral. The committee also recommends the grounding of transformer secondary lighting circuits, which seems to us to be good advice. Such connection intelligently performed puts an end to all danger to life by reason of crossing between the primary and secondary circuits, while the danger from fire is, in our opinion, less, since a defective transformer would be automatically cut off the primary circuit at the fuses, and would not be maintained in service in such a manner as to develop serious trouble at some unsuspected moment.

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## INJURIES BY LIGHTNING.

The meteorological report for the fatalities and injuries due to lightning during the year 1899 contains some interesting information. It seems that in the United States 562 persons were killed and 820 persons injured during that time, making a total of 1382 casualties, or nearly four casualties every day on the average. Among fatalities, it would seem that nearly half were indoors and half out-of-doors; of the latter, 11 per cent under trees. Among the injured, about 70 per cent were struck when indoors and 30 per cent when out-of-doors, and in the latter, 6 per cent under trees. The figures are, however, in all probability quite unreliable in regard to deductions as to the relative safety or danger of localities in which accident may occur, because on the near approach of a thunderstorm it is customary for all persons to take shelter indoors when possible, and consequently the number of people within doors during the prevalence of a storm would probably be many times the number of people out-of-doors at the same time.

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There is a general belief that a lightning discharge through the body of a human being tends to be confined to the surface of the body, owing to the "skin effect" of the body considered as a conducting medium. We are inclined to believe, however, that the influence of any such effect is greatly overestimated, partly because the frequency of lightning flashes is, perhaps, not excessively great, owing to the very appreciable inductance and capacity in the discharging system, and partly because the conductivity of the body is extremely small relatively to the metals in which skin effect is developed, say twenty millions of times less than copper. Consequently, since the skin effect for a given frequency diminishes with the conductivity, it is not likely to be very marked in the human body considered merely as a conductor.

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A very vexed question for which there never seems to be a decisive answer, is the efficacy of lightning rods on buildings. In the early days of this century, an objection which was raised to the erection of such rods was contravention of the designs of Providence, since some declared it impious to interfere with the thunderbolts of heaven. This allegation seems to have disappeared, and the only question that now reaches the attentive ear is the question of expense, and as to whether the "game is worth the candle," or insurance worth the copper. We would take the position that there is abundant evidence to show that lightning rods do protect tall buildings of non-conducting material, but that the protection is not always the most economical.

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Instead of carrying a single stout copper rod through insulators from the chimney top to the ground, we think it would be more effective to employ half a dozen uninsulated galvanized iron telegraph wires from roof to ground, and interconnect them all on the roof with the object of providing a conducting network enclosing the house, rather than an insulated duct beside the house. There are numerous instances on record of lightning discharges having been conveyed to ground from the tops of telegraph poles, through the ordinary No. 8 iron wire, provided for that purpose, without injury to the wire, and such material is both plentiful and economical. While it cannot be denied that a flat ribbon has less impedance than a round wire of the same cross-section, and that the impedance of a copper strip is less than the impedance of an iron strip for the probable frequencies of lightning discharges, yet we doubt whether the evidence at hand is sufficient to show the necessity of providing ribbons in place of wires; in other words, we think that iron wires for ordinary dwellings are sufficiently good. In the case of tall and expensive structures, such as stone church steeples where the cost of damage inflicted may be severe and the probability of being struck is also appreciable, the expense of a strip of copper or aluminum may be justified. But in all cases the ground that the eye sees not, is probably of more importance to successful insurance than the conductor that the eye can behold. The modern steel office building is of course a lightning conductor in itself, and it would be seemingly as useless to gild refined gold or paint the lily as to add a lightning rod to the skyscraper.

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It is interesting to observe the advances that have recently been made in the direction of definitely measured high electric potentials. In this connection, some recent experiments of Prof. Trowbridge with 20,000 storage cells of 40 kilovolts, charging glass condensers in parallel and throwing these condensers in series, has enabled pressures to 6 megavolts to have been reached. Prof. Trowbridge considers that air becomes a fairly good conductor to pressures of this magnitude. With pressures of 3 megavolts, sparks are produced 6½ feet long, possessing the principal characteristics of lightning discharges. The reports accompanying these discharges are certainly deafening in their loudness. Such sparks represent very roughly a metre of distance per megavolt of pressure. If the sparking distance remains proportional to the pressure, we should expect a lightning discharge of 1000 metres in length to employ a pressure of about 1000 megavolts. It may be quite possible, however, for the pressure to diminish as the distance becomes large, so that the pressures involved in lightning discharges might be much less so far as our present knowledge leaves undecided.

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## THE CONTROL OF PRINTING-PRESS MOTORS.

Motors driving large multiple-deck perfecting presses, such as are used for the daily papers of the larger cities, are called upon to

give a range of speeds and torques requiring unusual controlling mechanism. The customary range of running speeds can be easily met in the usual way, by means of shunt-field regulation, compound windings or armature resistance, but in addition to this range the pressmen call for some very low speeds for various purposes. For threading the paper, adjusting the ink, the impression, the tension, the folder, etc., a speed of about 3 to 5 per cent of normal is required; while for putting on and taking off the stereotype plates and for the many special operations frequently called for in a machine as complex as one of these huge presses, a motion aptly called "inching" is needed, this term signifying the intermittent advance of the mechanism by very short steps amounting to fractions of a revolution. These slow speeds are peculiarly difficult to obtain with the usual constant-potential motor started through a resistance, owing to the fact that the great multiplicity of gears, bearings, and so forth, of which a press is composed, tends to stick in whatever position it may be when stopped, and requires in order to start it a torque much greater than is called for after it gets in motion. In other words, a printing press has a very large friction of rest. The blankets on the cylinders, which force the paper against the cylindrical stereotyped plates, become deeply impressed by the plates in the position of standstill, and add to the force required to start the whole. In addition, the soft, jelly-like inking rollers yield to the force with which they are pressed together, and, when the press stands still, become to a certain extent flattened against each other, still further increasing the torque necessary to start the press. The result is that when the resistance in series with the armature of a motor driving such a press is reduced sufficiently to allow enough current to flow to pull all the parts of the press out of their respective ruts, the motor promptly runs up to about two-thirds of full speed.

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Although little is known on this point, it appears that the torque consumed by a rotary press does not drop abruptly from its high value at the instant of starting to a minimum value less than that of any higher speed. If the speed-torque curve of such a press should be laid out in the way that similar curves of induction motors are plotted—that is, with speed in a horizontal, and torque in a vertical direction—it would probably be found that the torque falls off steeply as the speed rises from zero to about 1 per cent, the fall of the torque gradually becoming less rapid, and rounding around to the horizontal at perhaps 3 to 5 per cent speed, the required torque gradually rising as the speed increases above that point. In other words, the required torque is a minimum at a speed of about 4 or 5 per cent and increases greatly at lower speeds. The result of this is, that the speed of a press driven by a motor with armature resistance is in unstable equilibrium down at the low values where the torque required by the press rises with reduced speed. A motor running at very low speed with its impressed e. m. f. largely absorbed by resistance, gives practically the same torque at 5 or 10 per cent of speed as it does at standstill. If this torque is sufficient to turn the press at, let us say, 3 per cent of full speed, and any lower speed calls for more torque, any disturbance, such as a hard spot in the press cycle, will cause the press to stop. On the other hand, if the speed rises slightly, due to any slight disturbance, the torque required goes down more rapidly than does that given by the motor, thus causing a great rise of speed before a balance is again struck. These speeds are those necessary for the operations mentioned above, and it is practically a physical impossibility to obtain them with armature resistance cutting down an impressed voltage sufficiently high to give full speed.

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One of the most simple and most satisfactory methods of getting over this difficulty is the use of two motors, one of the usual speed and power for full speed, and the other of comparatively small power and geared to run the press at the desired low speed. The small motor in such a case should be connected to the press through a ratchet, or its equivalent, so that it would not be driven at abnormal speed when the press is running fast. The high torque needed for starting the press can be given by the small motor with a far smaller number of amperes than by the large motor, owing to the comparatively large torque (at the press cylinder) per ampere in the small motor. By means of the ratchet, the small motor lets go as soon as the large one begins to drive the press above its speed. In this way, the extreme draft of current required to start a press is cut down, the small motor requiring no more current to start the press from standstill than the large motor requires at minimum torque. While the small motor must exert a torque at the press two or three times greater than that called for from the large motor, and hence apparently requiring that the small motor must have a greater rated power than that of the large motor divided by the speed ratio, the small motor is only used for comparatively short periods and does not require a large cooling surface. The teaser system, quite commonly used, is the equivalent of a two-motor system, but requiring three machines instead of two, and a correspondingly more involved system of controller connections.

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To obtain the same result with one motor, the simplest plan that suggests itself is the use of two or three cells of storage battery from which the armature could be supplied to give the very low speeds. In the case of a large printing establishment, the one low-voltage battery could be used for all of the presses, and could be recharged in the usual way by a motor-generator with practically no trouble compared with its advantages. For establishments with a single press the battery could be efficiently charged by running the motor in series with it for a sufficient time to restore the current drawn from it while running the press very slowly. A voltmeter could be used to indicate to the pressman, in the usual way, the need for charging the cells, and the added complexity of operation would appear to be slight compared with the advantages gained. The slow speed would be positive and the heavy starting current would be obtained from the battery, thus relieving the supply line of this sudden excessive demand which so seriously disturbs the voltage regulation of plants supplying printing presses especially when the latter are being "inched" along, intermittently drawing this excessive current from the supply system.

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At the present time no such application of storage batteries is made, but one method of control is used in which a resistance is shunted around the armature, the armature and its shunt resistance obtaining current through the usual series or controlling resistances, the effect being to give the armature a somewhat constant low potential resembling that obtained from a storage battery. Another possible method of obtaining very low speeds, and an attractive one from a scientific standpoint, is the development of a motor with a torque-speed curve dropping more rapidly than does that of the press at the low speeds wanted. While this appears at first sight to be a simple proposition, it is difficult to see how it can be obtained. A series-wound motor gives a much sharper fall of torque with increasing speed than does a shunt-wound motor, especially if the series machine is worked below saturation. It should, however, have as small a resistance as possible in series with it, and this for low speeds means a large and expensive motor. The series motor also has the advantage over the shunt or compound in the matter of starting current. A light differential shunt field opposing the predominating series field would cause the torque to fall more rapidly, but would, it is hardly necessary to say, have disadvantages. The value of a rapid fall of torque with slight rise of speed from a standstill for this and similar work gives a fine opportunity for invention.

## Electrical Equipment of New York Elevated Roads.

At a meeting of the executive committee of the Manhattan Railway Company Tuesday of this week, several contracts were approved which practically complete the apparatus necessary for the central power station at Seventy-fourth Street and the East River; and it was definitely promised that trains would be running by electricity by Feb. 1, 1901. The report of the company's experts on the question of car equipment was also considered, and the committee directed the adoption of the double-end train system—that is, a motor car on each end of a train, each equipped with four motors, and sufficiently powerful to haul six-car trains. Each motor will be of 100 horse-power, thus giving 800 horse-power per train. Contracts were authorized for an electric stairway at Fifty-ninth Street and Third Avenue, and for one of another type at Twenty-third Street and Sixth Avenue, these to be followed, after trial, at other important stations by whichever seems to be best to meet the public needs.

The Westinghouse Company receives the contract for the generating plant. The Allis Company will furnish the engines, of which there will be eight of 8000 horse-power each, capable of working up to 12,000 horse-power. The boilers will be supplied by the Babcock & Wilcox Company. The contracts so far entered into involve $5,000,000. The first engine is to be delivered early in September.

## The Telephone Situation at the Head of Lake Superior.

There is now being carried on in the cities of Duluth, Minn., and Superior, Wis., a vigorous war between Bell and independent telephone companies. The situation appears to be briefly as follows: There are two cities to be served, situated about five miles apart on opposite sides of the harbor; the larger, Duluth, has a population of about 60,000, and the smaller, Superior, has about 35,000. The business of these two places is largely shipping, and there has up to the present year been no telephonic communication with the outside world. About a year ago the franchise of the Duluth-Superior Telephone Company, a Bell organization, in Duluth expired, and the city advertised for competitive bids for a new franchise. The existing company paid no attention to this request, but an independent organization, the Zenith City Telephone Company, bid 1½ per cent of its gross receipts and fifteen free telephones for the city, and received a twenty-five-year franchise. The new company was organized with an authorized capital of $200,000, and has put into service an extensive and most excellent independent plant. A closely allied organization, termed the Peoples' Telephone Company, with an authorized capital of $100,000, operates in Superior under a twenty-five-year franchise, paying 12½ cents per telephone per year to the city. The two companies work together, there being no toll charge for connection between the two cities.

The franchise of the Bell Company expiring, this company was requested by the city to remove its wires and poles from the streets, but no move in that direction has been taken, the company having obtained a temporary injunction, restraining the city from interfering with its business. The company, however, occupies the unique position of operating without a franchise, and in spite of this condition has erected a building for its exchange, and is putting in a complete common-battery system with all the latest improvements to replace the very poor and obsolete system with which it was giving service up to the time of competition. Its wires are all overhead.

The exchange of the new independent company in Duluth is located in the best office building in the city, and contains a Stromberg-Carlson multiple central-energy switchboard, designed for an ultimate capacity of 3600 lines, with sufficient panels in place at present for 1200 lines. The company now claims to be giving service from this board to about 1000 subscribers, with about 100 more in the suburbs of Lakeside and West Duluth, between 500 and 600 being connected to the two exchanges on the Wisconsin side of the harbor at West Superior and Old Town respectively. The business is growing so rapidly on the Duluth board that extensions have already been ordered.

The features of this switchboard are those of the latest Stromberg-Carlson practice, each operator having charge of 100 answering jacks, the whole board being multipled in front of every three operators' positions. There are 12 pairs of cords to each operator's position with one visual clearing-out or supervisory signal in each pair of cords. The line signals are self-restoring magnets with one pilot lamp per panel. There are the usual distributing and intermediate boards, relay rack, and a duplicate storage battery of the American type, each battery having a capacity of 250 ampere-hours at 40 volts, the pressure used upon the lines. The batteries are charged by means of a 2½-hp Crocker-Wheeler motor-generator, taking power from the isolated plant of the building, one battery being charged while the other is in service.

The lines of the company are largely in lead-covered cables, all the down-town lines being carried underground, the distribution through the residence districts being carried through the alleys. The larger and more important office buildings are reached entirely by means of underground cables with no overhead distribution whatever. The cables at present in use are Roebling 100-pair with Moon terminal heads, some further cables to be put in in the near future being 150-pair; practically all the lines are copper throughout. The trunk line from Duluth to Superior consists of a 50-pair cable through from exchange to exchange, with the exception of the river, crossing under the draw bridge, which is made in two 25-pair submarine cables. There are two private-branch exchanges in the system, one with thirty telephones. The rates charged, and specified in the franchise, are, for business places $35 for the first year and $30 per year for succeeding years; for residences $20 per year, $10 being charged for extension instruments. There are no party lines.

This system, although equipped with the very best of apparatus, has been installed in Duluth with a bonded indebtedness of only $50,000, in 6 per cent five-year bonds, which were sold at par, and largely taken up by the officers of the company; there is practically no floating debt. The Superior system is not bonded at all.

The officers of the Zenith City Telephone Company are: E. S. Upham, president; L. S. Loeb, vice-president; C. F. Leland, treasurer; G. W. Buck, secretary, and C. C. Kreitzer, manager. The stockholders are largely local residents.

The hold of the old company on business, in spite of the lower rates and larger number of subscribers of the new company, is largely due to the long-distance service which was recently started, the American Telephone & Telegraph Company having completed within the last few months a line from the Twin Cities, St. Paul and Minneapolis, to the head of the lakes, 150 miles. This line carries two circuits, one of No. 8 wire and one of No. 10 wire, and does a very large business not only to St. Paul, Minneapolis and Chicago, but also to Cleveland and Buffalo on account of the extensive traffic in grain, coal, iron and lumber between the head of the lakes and these points. Service is also given through to New York and Boston, the distance from New York being some 1600 miles. The rates are 75 cents and 40 cents to St. Paul; $2.75 and $1.40 to Chicago, and $10 and $5 to New York. On account of the long-distance connections the commercial and railroad offices require the Bell instruments, and as these offices do not care to reach the public, they do not patronize the independent service. The public, however, wishes to reach these offices, which compels in many cases the unfortunate necessity of two telephones per subscriber. The local Bell Company expects to further fortify its position in the same way by the erection of long-distance toll lines to the iron ranges north of Duluth, which will command a large amount of business from Duluth subscribers, as well as add to the business over the long-distance lines of the American Telephone & Telegraph Company to the home offices of the iron concerns in Chicago, Cleveland and New York.

The local Bell Company claims that it has retained, in spite of competition, 1000 paid subscriber's stations in Duluth, and over 619 in Superior, and has many orders for new service. Its regular rates are $50 per year for Blake instruments on common-return special lines, for either business places or residences, and $72 for solid-back instruments on metallic special lines for business places, and $60 for the same service to residences, with party-line rates in proportion. These rates are, however, considerably cut at present. Many coin-in-the-slot telephones are also in service. In spite of its anomalous position without a franchise, the company is, as noted above, practically rebuilding its system with up-to-date apparatus. It has erected a new building, 35 ft. x 110 ft. in size, with two stories and basement, for its exchange, and is installing a complete common-battery, visual signal board of the Western Electric Company's very latest type, with all improvements and such details as the four-party selective-call system for party lines. The ultimate capacity of this board and of the room provided for it is 5400 lines, the immediate capacity to be 1200. The chief officers of the Duluth Telephone Company are Col C. H. Graves, president, and C. M. Mauseau, manager.

## Electric Automobiles in Boston.

WHEN the attempt is made to start an electric automobile service in a large city and the charging station is required to handle a considerable number of vehicles, such as 100 or more, it is at once found that an elaborate systematic scheme of rules, inspections, repairs, etc., must be worked out, for which as yet there is little or no precedent. The growth of the business is, as a rule, so rapid that the abilities of those in charge are severely taxed to develop these methods with sufficient promptness and prevent utter chaos in the handling of the business. The experience of the New England Electric Vehicle Transportation Company in this line in Boston may be interesting to all who are confronted with the same problem, as this company has developed a most thorough system of operation, care and attention in an almost incredibly short time.

The company started giving service in Boston in the month of May, 1899, the first venture being with three cabs. It now handles some 150 vehicles, among them 30 broughams, 20 extension broughams, 20 hansom cabs (to which 30 more will soon be added), as well as delivery wagons, surreys, stanhopes, runabouts, etc. The provisions for thoroughly caring for, inspecting, and repairing this number of vehicles and supplying them with power are by no means easy to get into systematic operation in a few months' time.

The company has purchased for a central charging station the property known in past years as the "Boston Cyclorama," situated on Tremont Street slightly south of Dover. The building is 16 sided in shape, about 125 ft. between walls. When obtained it consisted only of the bare walls and roof. The battery-charging rooms will be located on the ground level of the building, while for the vehicle loading, cleaning, storage and inspecting space another floor has been built at a height of about 12 ft. above the ground. The new structural work is of the most substantial character, the floor being of vitrified brick resting on brick arches supported on steel girders and columns. Heavy steel girders have also been put in the walls at the proper height to support another floor above that now in use, in order to provide further storage for vehicles.

To provide an entrance to the operating floor, as it might be called, one of the 16 sides of the building was broken out, and a runway was constructed down to the street level. This runway is also floored with vitrified brick, the walls being faced with white glazed brick in order to give an attractive appearance. A heavy cast-iron guard rail divides the runway into two parts, one for incoming and the other for outgoing vehicles. At the outer end of the runway are doors which roll up like a roll-top desk. These will eventually be worked by motors. Above the runway are the offices. Provision is also made for tired vehicles coming in with exhausted batteries which could not climb the 8 per cent grade of the runway. For these there is an entrance into the lower floor with a loading stand for removing their batteries and an elevator for transferring them to the operating floor.

FIG. 1.—GENERAL VIEW OF THE OPERATING FLOOR IN THE CONVERTED CYCLORAMA BUILDING.

The battery handling is at present accomplished by temporary means. The equipment now under construction will provide eight loading stands fitted with vehicle-centering devices and a mechanism for pulling the batteries out horizontally and replacing them with others, the whole operation being in principle somewhat similar to that used in the pioneer New York City station, previously described in these columns. The loading stands in Boston will not deliver the batteries directly to the crane, which carries them to the charging tables, but will deliver them to elevators which will take them

to the lower floor, where they will be transferred to the crane trolleys. There will be one of these battery elevators for each of the eight loading stands, and each elevator will have five shelves, one above another, something after the fashion of a dumb-waiter, these five levels giving room for several batteries on each elevator. In operation the elevator will rise from the charging floor to the vehicle floor with four fresh batteries, the top level being vacant. The loading apparatus will pull out an exhausted battery from the vehicle, place it in the vacant level of the elevator; the latter will

FIG. 2.—THE RUNWAY OR ENTRANCE TO MAIN CHARGING STATION.

then rise one level, bringing up to the loading level a fresh battery, which is then put in the vehicle. The vehicle then moves away, another being brought up in its place, the exhausted battery of the second vehicle being moved into the elevator in place of the fresh battery previously taken out for the first vehicle. The process will be repeated until all the charged batteries in the elevator have been replaced by stale ones, when the elevator will descend and transfer the exhausted batteries to a crane on the lower floor, obtaining

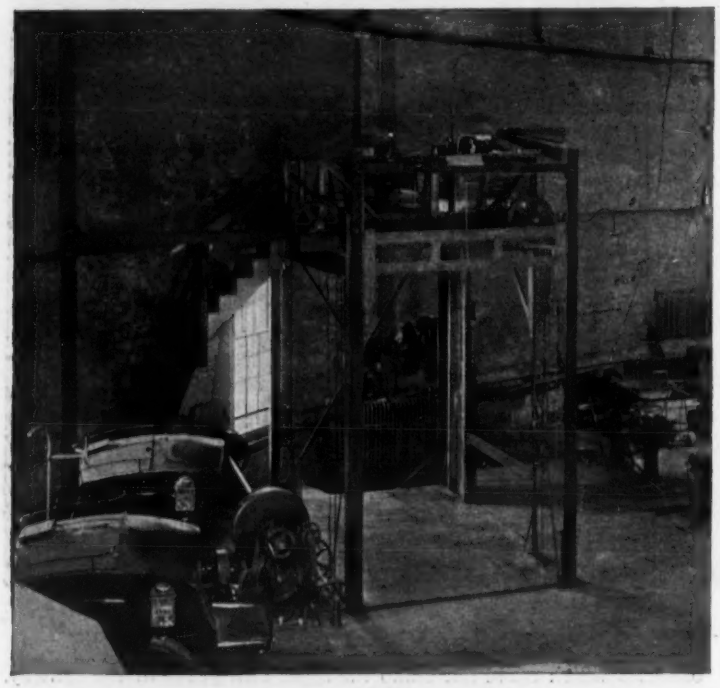


FIG. 3.—ELEVATOR AND FLOOR MANAGER'S STAND, SHOWING MEGAPHONE FOR DIRECTING THE DRIVERS.

freshly charged ones in their places. Power is obtained from the three-wire circuits of the Boston Edison Company, boosters being used to insure that the voltage supplied to the batteries will always exceed their counter e. m. f. The control of the charging current is accomplished by means of a rheostat for each separate battery, no multiple-bus arrangements with different voltages being provided. At present the resistance of the individual rheostat is simply made high when the charging commences, and is then gradually cut down so as to charge the battery at practically constant current.

For shifting the vehicles around the building during the time that they are out of use, which is, as a rule, from midnight until 7 a. m., and while their batteries are being recharged, there is provided an ingenious arrangement which is termed a trolley. This consists of a two-conductor cord and attachment plug hung from the centre of the roof and counter-weighted. A source of current supply is obtained from the two-conductor cord for moving the vehicle around the station by means of its own motors. The trolley supplies current at low voltage so as to enforce slow motion. This arrangement does away with the need of several men to push and pull the vehicles around the station. One man, termed the "trolley man," is especially assigned to the duty of operating the vehicles while they are out of service, moving them from the loading stands to the washing platform, sorting them and packing them away in suitable rows from which they can be readily taken in the proper order when wanted.

There is also another trolley for use over the three pits which are provided to give easy access to the running gear for inspection and repairs. This trolley supplies power to run the motors under test while the vehicles are jacked up, the fall of potential and current in several parts of the circuit being measured to discover any electrical faults of the apparatus or connections. A fourth pit is provided with a special elevator for loading underslung batteries in delivery wagons.

The inspection of the vehicles is very complete. Every morning every vehicle that has been out is looked over by three men, who are on duty from 1 a. m. to 1 p. m. One of these is an inspector, who goes over every bolt of the running gear, screws up every contact of the circuits, files the controller fingers, and examines the commutators, brushes, etc. The second of the three men is an oiler, who oils the wheels of all vehicles one day, the running gear the next, and the motors the third. The duty of the third man is simply to inflate the tires, the front tires of all vehicles being inflated one day and the rear tires the next. The inflation is accomplished with compressed air at a pressure of 140 lbs. per sq. in. These three men catch many faults before they become sufficiently serious to do any damage. Once a month each vehicle is practically dismantled and reassembled, all wear being taken up and severely worn parts being renewed.

Even to such details as the keeping of the tools, the work of this company is thoroughly systematized. All special tools, such as those

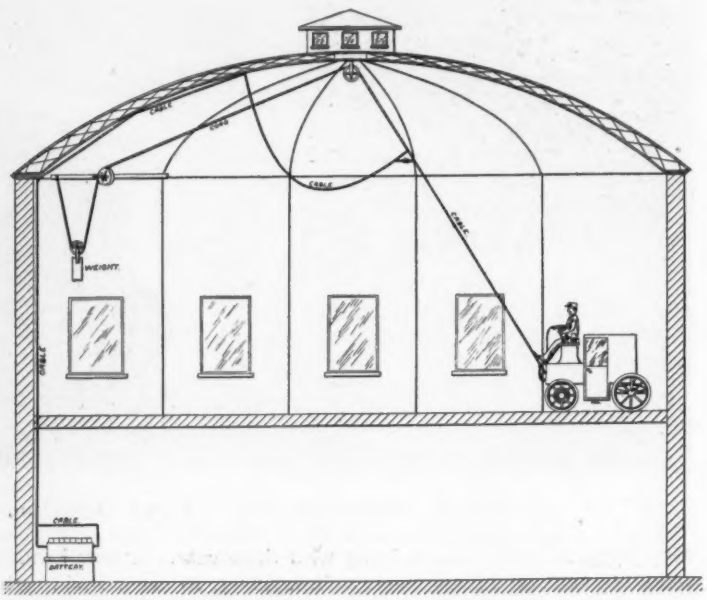



FIG. 4.—SKETCH SHOWING METHOD OF SUPPORTING TROLLEY.

used for changing tires, putting on creepers, removing pinions etc., have their individual positions on a panel on which their shapes are painted, thus showing at a glance what tools are missing. The men are required to furnish their own ordinary tools with the exception of those, such as files, that wear out. Other large and expensive tools are obtained by check from a foreman.

Another novel feature in this automobile station is the tire repair work, a special room being fitted up with a vulcanizing furnace and

is vulcanized in place. The repairs have proven very satisfactory.

The batteries are also given unusual care, the plates being entirely separated and taken out from time to time, each plate being scraped with blunt-edged wooden tools, and scrubbed with heavy brushes before they are reassembled and burned together again in the connecting lugs. An ingenious arrangement is provided for measuring the specific gravity of the acid. This consists of a hand suction pump which draws the acid from the battery jar up through a flexible rubber tube into a piece of glass tubing, within which the hydrometer is mounted. With a few strokes of the pump the acid is drawn up until the hydrometer floats, when it can be read, after which the acid can be restored to the battery jar by simply admitting air. One of these hydrometer equipments mounted on a small truck by which it can be rapidly moved from battery to battery, is shown in Fig. 5

The company is making a most complete collection of data on which to base changes in its system of operation or in the construction of the vehicles. In the office are complete data files, each separate vehicle having a pigeon hole in one file and each separate battery having one in another file. Complete information concerning each repair job on a vehicle or battery is filled out on a blank card, serving as a shop order. When the repairs are completed, each card is filed in the pigeon hole of the battery or vehicle on which the repairs were made; thus each pigeon hole contains cards giving a complete history of all repairs and changes on the corresponding vehicle or motor. From time to time these histories are taken and classified by a "statistician" in what are termed battery records, motor records, vehicle records, etc. The statistician also works up the costs per mile of 16 different detail parts of the vehicle, such as the bearings, gears, wiring, etc. From these records of costs the influence of any change of design can be immediately and accurately determined.

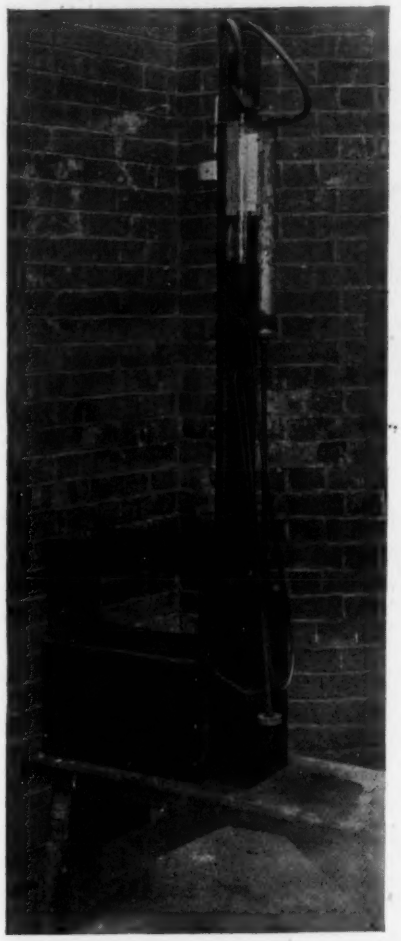


FIG. 5.—PUMP FOR DRAWING ACID AROUND HYDROMETER.

In addition to the central charging station the company is equipping a number of sub-stations to increase the radius of action of its vehicles in the suburbs. A ring of sub-stations is being established at a radial distance of between four and five miles from the downtown central station. There will be four of these sub-stations in this ring, located respectively in Cambridge, Chestnut Hill Reservoir, Dorchester and Chelsea. Later another ring at a greater radius will be added to still further increase the distance which a vehicle can travel with no more trouble than replacing its battery one or more times at one or more of the sub-stations. Two of these sub-stations, those at Cambridge and Chestnut Hill Reservoir, are now in operation. Several interior views of the latter are shown in the accompanying cuts. The station consists of one ground-floor room about 15 ft. x 30 ft. in size, and basement. The latter contains a Westinghouse gas engine belted to a small dynamo for charging the batteries. The main room contains one loading stand and five charging stalls. At the loading stand the battery can be pulled out from the vehicle and placed on a truck by which it can be moved into any one of the charging stalls. When in position a counterweighted frame is lowered over the battery, making the proper connections. The station is equipped with a long flexible lead or trolley, as it is called, for reaching the street for vehicles which, on account of exhaustion, could not otherwise climb the slight grade to the sub-station door.

The New England Electric Vehicle Transportation Company is

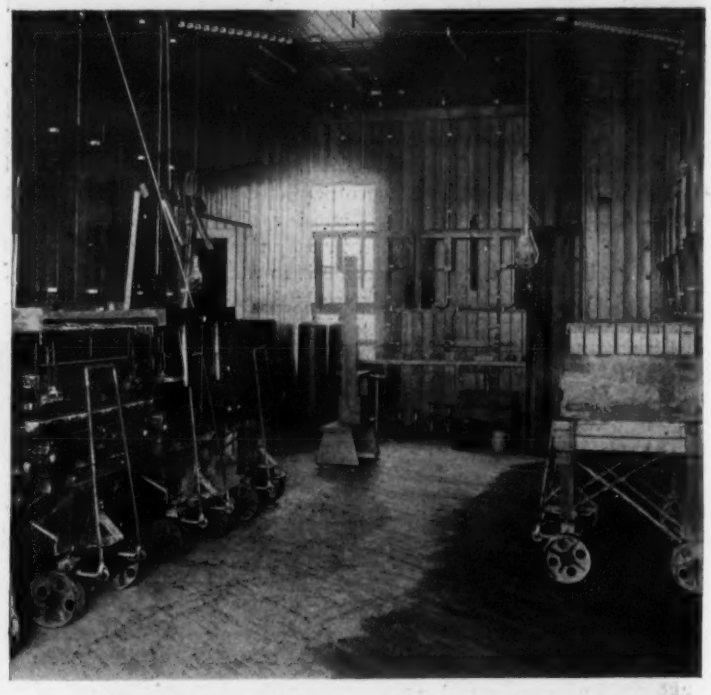


FIG. 6.—VIEW OF CHARGING STALLS, CHESTNUT HILL SUB-STATION.

an organization representing the Electric Vehicle Company in the New England States. It uses the standard vehicles of the parent company, and the results of its records of life and cost of parts are transmitted to the parent company for the benefit of the latter in

FIG. 7.—VIEW OF LOADING STAND AND SWITCHBOARD, CHESTNUT HILL SUB-STATION.

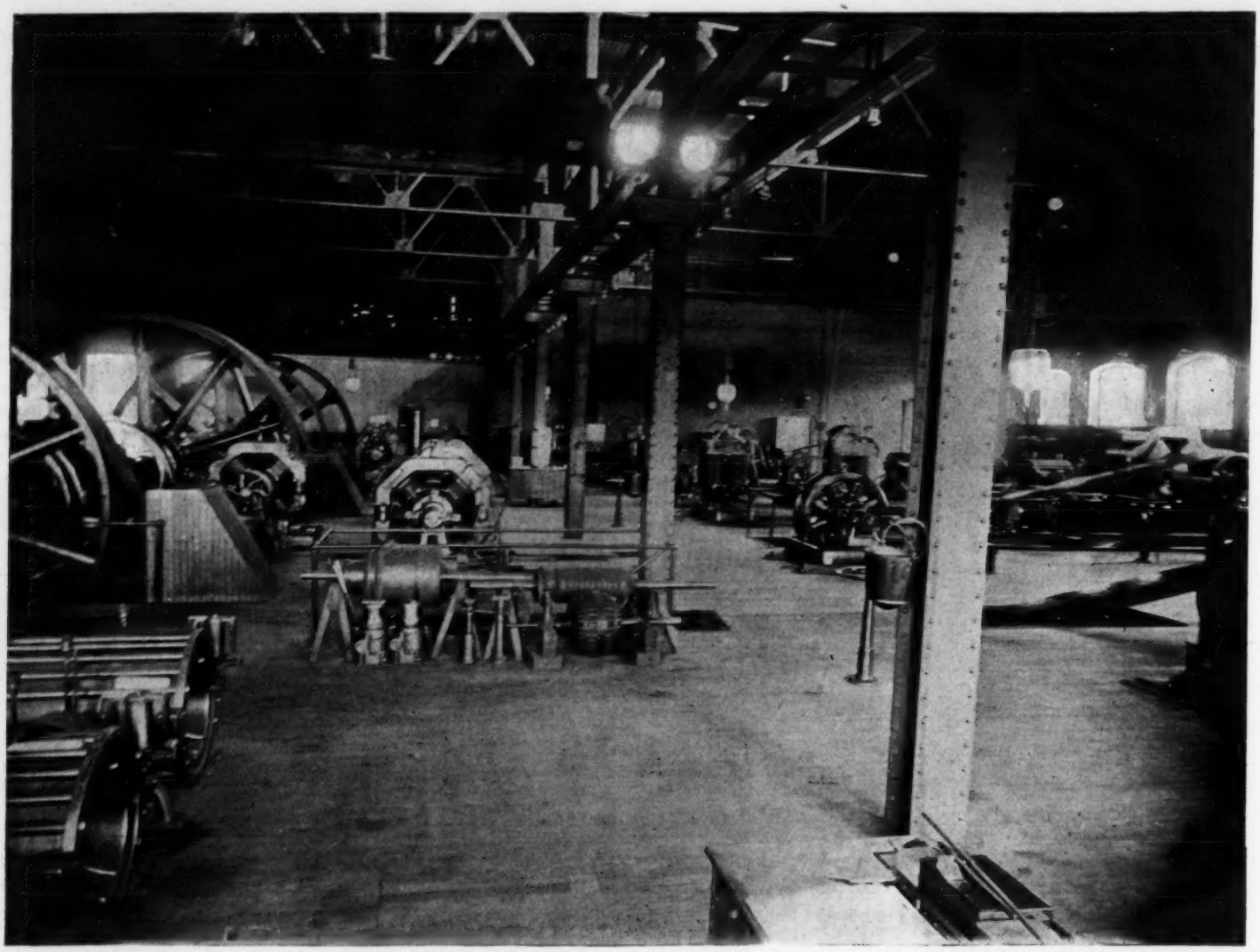
design changes. In addition to the city of Boston the New England Company is working in Newport, where it will have much better facilities during the coming season than it had at this place last year. The company is capitalized at $5,000,000. The officers are as follows: George Von L. Meyer, president; C. L. Edgar (president of the Edison Electric Illuminating Company, Boston), vice-president; T. K. Cummins, treasurer; Knight Neftel, chief engineer and general manager; Spencer C. Crane and Carl L. Morgan, assistant engineers. To the latter gentlemen credit is due for the original ideas in automobile working mentioned above, as well as thanks for information concerning them.

## Central Stations in the South—II.

CONSOLIDATED ELECTRIC LIGHT COMPANY, OF BIRMINGHAM, ALA.

By W. S. Key.

PROBABLY no other city in the South makes more general and extensive use of electricity for various purposes than does Birmingham—the Magic City—Alabama. In the year 1880, this now wonderful city was a small country town of 2000 people, many of whom were employed at the one or two blast furnaces and iron works which had been founded there soon after the discovery of rich deposits of iron ore. To-day it is one of the handsomest and probably the richest and most prosperous cities in the country. It boasts a population of 80,000 souls, and is rapidly advancing to a position in this country similar to that held by the city after which it was named in England, which will entitle it to rank as the metropolis of the iron, steel and general hardware business in the United States.



View of Power Station Consolidated Electric Light Company, Birmingham, Ala.

Its electric light and electric railway facilities are among the best going, while the general and diversified use of the electric current in the mammoth steel works, by-product plants, wire rod, bar and plate mills is fast transforming those branches of business and becoming invaluable auxiliaries to steam and hydraulic power. In the million-dollar steel plant just completed at Ensley, a suburban town, by the Tennessee Coal, Iron & Railroad Company, electric power is so generally used for operating colossal rolling mills, with all their complicated machinery, that the smelting, heating, carrying, rolling, cutting and loading is done entirely by automatic mechanical means, the motive power for which is the electric current.

One of the wonders of the Magic City is the powerful and extensive electric plant at these works; though the plant from which the city itself is illuminated, its citizens transported and much of their business done, is one of the most extensive in the South, yet too small to meet the requirements, and so is being doubled in capacity at a cost of about $200,000.

It is fifteen years since electric lighting was first introduced in that city, by a concern known as the Birmingham Gas & Electric Light Company. As the city was then growing at a great rate, the Edison Illuminating Company was the next to enter the field. Next came the Merchants' Electric Light Company, followed by the Peoples' Electric Light Company, and still another known as the Stephens Electric Light Company. One by one, these various corporations ceased to exist as independent concerns, and finally the existing corporation, known as the Consolidated Electric Light Company, succeeded to the entire business, and is rendering a more satisfactory service than all its predecessors combined.

Its central station is a large and handsome building on Parnell and Nineteenth Streets, a short distance from the centre of the city, and right on the main line of four of the leading railway companies, the Louisville & Nashville, the Alabama Great Southern, Central of Georgia and Southern Railways. It is built entirely of brick, with steel-girder roof, gravel covered, 150 ft. x 150 ft., now being enlarged to 200 ft. x 150 ft. The engine room is 95 ft. x 150 ft., but will be, when altered in accordance with the new plans, 55 ft. x 250 ft. The boiler room is 55 ft. x 150 ft., and will later be 95 ft. x 250 ft. The present boiler plant consists of 15 tubular boilers, 16 ft. 6 in. each, built by the Birmingham Boiler Works, to which 9 more of like dimensions are now being added. All the steam pipes are arranged according to what is known as the double-headed system. The chimney stack connected with the boilers is of steel, 150 ft. high, 8 ft. 2 in. diameter, and lined 50 ft. up with fire brick, the remainder with common brick. A second stack is now being erected, having the same height, but being 10 ft. 2 in. in diameter.

All the direct-connected apparatus is in the engine room, while plans are being carried out for installing all belted apparatus in a separate room. From the generators to the switchboard, and thence

to the outside of the building, all wires, will run underground to the point where they will join the pole line.

ENGINES.

The engine equipment of this central station, as at present in operation, includes two engines of 500 horse-power capacity of the Lane & Bodley type; one engine of 400 horse-power, same type; one of 150 horse-power, same make; one Harrisburg engine of 430 horse-power capacity, and two Birmingham Machine & Foundry Company engines of 1000 horse-power each. Included in the extensions now being made will be one pair of twin engines of 2000 horse-power capacity.

OTHER APPARATUS.

A Wainwright feed-water heater of 2500 horse-power supplies the boilers at present, but three more are to be installed. The separator in use is one made by the East Birmingham Foundry & Machine Works. The company has decided to install a set of apparatus for handling coal, as the consumption is great, and any saving, whether of time or money, or both, effected will, of course, be an advantage to the stockholders. The regular pressure at which the boilers are run is 110 lbs. Valves used throughout the works are of the well-known Chapman type, up to 6 ins., while smaller sizes are of the Jenkins type. Three Worthington pumps, 4-in., of the well-known duplex type, have done duty thus far, but more are to be installed. As much of the machinery is very heavy, for facility in handling same there are two G. E. electric cranes, of 8 tons capacity each. A third one is to be added that will lift 30 tons.

As in this station current is generated for operating the entire railroad system of the city, quite a number of pieces of apparatus have been installed and are run for that purpose solely. The railway generators consist of four M. P. 80s; two M. P., 300 kilowatt; one 850 kilowatt, all of the well-known G. E. type; others are now being installed.

LIGHTING APPARATUS.

The lighting plant includes four 60-kw Edison, two 25-kw Edison and one direct-connected set of 200-kw G. E., 110 volts. There are, in addition, one 100-kw alternating monocycle, one 250-kw alternating monocycle machine for long-distance transmission; eight 50-light, 1200-cp T.-H. machines; two 125-light, 2000-cp Brush machines; one Ball 40-light, 1200-cp machine, making twenty machines all told, and these are in regular service. The extension now under way will include one 850-kw, 500-volt machine, one 400-kw direct-connected machine. For operating these new machines there will be a pair of 2000-hp engines installed.

The lighting capacity of the station is 665 series arc lamps, to be largely increased. These are the street lights throughout the city. Then there are 400 enclosed arc lamps in circuit for commercial service in stores, office buildings, hotels and similar buildings. These are run on a 110-volt circuit. At present over 1500 incandescent lamps are in regular service, with a phenomenal demand for increase, while the company's motor circuit of 500-horse-power is taxed to the utmost supplying current for fans, elevators, sewing and dental machines, blowers in foundries and other factories.

Six transformers of the G. E. type are used of 75 kilowatts each. Throughout the city red cedar poles are used exclusively, having standard cross-arms and insulators.

As the territory is so extensive over which current has to be transmitted for lighting not only the city proper, but also the outlying manufacturing and residential suburbs, the company has found it to be an advantage to build two sub-stations. One of these is at Pratt City, seven miles from the central station, with a capacity of 3000 lights. A second one is between Woodlawn and Avondale, three and a half miles distant, having a capacity of 3000 lights.

So rapid has been the growth of this, the so-called Magic City, that several enterprises which serve the city in various ways have found it next to impossible to keep pace with the constantly increasing demand for service. Hence it is that the Consolidated Electric Light Company has had to extend, enlarge and increase its facilities from time to time. At the present time its central station is a finely-equipped up-to-date station, but altogether inadequate to supply the demands made upon it. To obviate this difficulty, plans have been drawn for a material enlargement, and included in the extension will be one 850-kw, 500-volt generator, one pair of twin engines of 2000 horse-power, one 400-kw generator, with direct-connected twin engine. The work of extension is being carried out under the supervision of Messrs. Stone & Webster, the well-known electrical engineers of Boston, who are the engineers for the Birmingham Consolidated Electric Light Company, Mr. J. M. Bradley being general superintendent.

Owing to the low price of coal, and the cheap rate at which it can be conveyed from the collieries to Birmingham, and there dumped where it can be fed into the furnaces at a minimum of cost for labor, the company is enabled to furnish current at a cheap rate, consequently the demand is rapidly increasing. With the completion of the extension, Birmingham will possess one of the very finest central stations throughout the South.

## The Action of the Wehnelt Interrupter on Alternating Currents.

BY GEORGE T. HANCHETT.

ON an alternating-current circuit of 8000 alternations per minute, the Wehnelt interrupter operates well, and produces some powerful and brilliant secondary effects. The secondary discharge is not of the striated character that obtains on direct-current work, and for short distances is yellow, fuzzy and calorific. For long distances it becomes crisp, blue and snappy, the dividing line between the two kinds of spark being quite abrupt. In some experiments, as the secondary terminals which were supporting the crisp blue spark were slowly approached, there suddenly appeared at a striking distance of about three-quarters of an inch and coincidently with the blue spark, a yellow calorific spark which was distinctly separate, and not until the discharge rods were very closely adjacent did the discharges unite with a single calorific spark. From what appears beyond there is reason to believe these two discharges were respectively a positive and negative discharge occurring alternately, though to the eye simultaneous.

The interrupter action was quite violent, and the metal plate forming one terminal seemed to be attacked and quickly rendered the solution turbid. This was undoubtedly due to the effect of nascent oxygen, which was generated there to a much greater extent than in direct-current working. In general, it may be stated that the secondary discharges on alternating current Wehnelt interrupter circuits are not as brilliant and are of lesser voltage than in the case of direct currents.

The secondary discharge exhibited no polarity phenomena when striking through short air gaps or through a low vacuum tube. Reversing the terminals made no difference, but the writer was rather surprised to note that on Roentgen-ray tubes of moderately high vacuum, polar phenomena are most pronounced. With one connection a Roentgen-ray tube works excellently, while in the reverse the tube fails to concentrate bombardment on the target and the Roentgen rays appear only to a very limited extent. The tube worked very evenly and steadily and did not vary in its effects. The effects occurred no matter what size of interrupter was used.

The inference to be drawn from this is that the primary current wave has a steeper rate of change on the decrease side, and further, that with given conditions, the wave retains its form approximately; that is to say, the interrupter breaks current at the same point of the alternating current wave at every interruption, for the polar phenomena did not vary in any one set of adjustments.

If the above be true, it follows that the pitch of the interrupter is a function of the alternator frequency, and does not depend on the amount of platinum projecting, as in the case of direct currents. That this is a fact is demonstrated by the action of interrupters of different sizes. All gave the same pitch as the alternator frequency as far as could be determined, and the only observable difference was in the secondary voltage which was, of course, less with the smaller interrupters.

It is not at all surprising that an interrupter should act on a single unvarying point on the fundamental wave, because direct-current experiments have shown that the action of the interrupter is dependent on current density and direction. On direct currents the interrupter, if made the positive, will work excellently, but if made the negative, the point gets exceedingly hot, due to the forge effect, and if it interrupts at all works only indifferently. It is evident, therefore, that the interrupter on alternating currents will break circuit at a certain point of current density on each positive wave, determined by the conditions, and it is easy to see that such a rupture of the circuit will give a resultant current wave of same frequency as the alternator primary and with a steep decrease side, and hence

secondary discharges which prevail in one direction. If the above be true, the size of the interrupter point determines the point on the wave where the current is to be broken, the requisite current density being attained sooner with the smaller points. It is also reasonable to conclude that at sparking distances where both calorific and blue spark occur, that the calorific spark is due to the less rapid but more prolonged rate of change of the increase side of the primary crest, and the snappy blue spark is coincident with the steeper but less prolonged decrease side.

It may be hazarded as an explanation of the disappearance of polar phenomena on low vacuum tubes and short air gaps, that these were of sufficiently low resistance to receive the discharges in both directions, while the higher-resistance tubes responded only to the impulses of higher potential, which were all in one direction.

Every one who has experimented with the Wehnelt interrupter on direct currents has doubtless encountered the disagreeable sticking or gagging of the interrupter when it gets hot and fatigued. It has been stated that heating the tip of the interrupter to redness in the flame of an alcohol lamp will restore it. The writer never got any further in this experiment than cracking the interrupter; or if sufficient time was taken to thoroughly clean and dry the tube before heating and the heating applied sufficiently slowly, enough time was consumed for the interrupter to restore itself by the simple process of cooling. Be that as it may, it is a fact that on alternating currents the annoying refusal of the interrupter to work when hot is entirely absent, and perhaps the heating that the platinum point gets when it receives a forge effect as a negative terminal, has something to do with it. Certain it is that the forge effect is present, for the interrupter point working on alternating currents appears exactly like an interrupter on direct currents connected up the wrong way. The rosy red appearance of a properly working direct-current interrupter is replaced by a glaring white.

On Applying suitable instruments on the interrupter circuit excited by alternating currents, it was found that the energy was divided practically evenly between the interrupter and the coil; if anything, the interrupter absorbed slightly more energy than did the inductive part of the circuit. There was very little displacement of the quantity of the alternating-current wave from the zero line, a d'Arsonval instrument showing only a very slight deflection when shunted around the various portions of the circuit. It was further noted that the electromotive forces around the various points of the circuit, while in some cases greater than the line potential, and therefore displaced in phase from each other, yet gave rise to effects by no means as pronounced as in the cases where direct currents were used.

It is probable that the break of the Wehnelt interrupter on alternating currents is not so abrupt as is in the case of direct currents, the reason being that the e. m. f. is applied gradually to the interrupter point occording to the sine law or the equation of the fundamental wave. In direct currents the full electromotive force is applied more promptly, and undoubtedly produces a steeper decrease wave. This should account for the fact that, other things being equal, greater secondary potentials are observed with the Wehnelt interrupter on direct-current circuits than on alternating; and it should also point to the explanation of the fact that the condenser and inductive e. m. fs. of the primary circuit do not sum up arithmetically to so large a value when alternating currents are used.

## American Association for the Advancement of Science.

BY WILLIAM H. HALE.

THE annual meeting of the American Association for the Advancement of Science will be held at Columbia University, in New York, June 25-29. This is the first meeting ever held in June. The change was partly to accommodate members who wish later to visit the Exposition at Paris, and partly to avoid the physical discomfort often felt from the oppressive heat of dog days, as was the case at the Columbus meeting last August.

It is intended to make this pre-eminently a working session, and excursions and entertainments have been realy eliminated, though some excursions may be arranged for Saturday.

The president of the association is Prof. Grove Karl Gilbert, of the United States Geological Survey, a prominent investigator and writer on geological matters, a native of Rochester, N. Y., and graduate of the Rochester University in the class of 1862. Prof. Gilbert is one of the original fellows of the association, of whom only about sixty now survive. He has paid much attention to the study of the Niagara gorge and the Lake Ontario terraces, as well as many other regions. He was elected by the council to succeed Prof. Edward Orton, who presided at the Columbus meeting, but died soon afterwards. Prof. Gilbert will deliver the annual presidential address at the Museum of Natural History on the evening of Tuesday, June 26. The reception to members will follow the address.

The president-elect is Prof. Robert Simpson Woodward, of Columbia, who is also treasurer of the association, and president of the New York Academy of Sciences and of the American Mathematical Society.

The headquarters at Columbia for the approaching meeting will be at Schermerhorn Hall. The hotel headquarters will be at the Hotel Majestic, Central Park West and West Seventy-second Street.

The opening exercises will be held in the gymnasium of Columbia at 11 o'clock in the morning of Monday, June 25. The meeting will be called to order by the retiring president, Prof. Gilbert, of Washington, who will introduce President-elect Woodward. Addresses of welcome are expected from Governor Roosevelt, Mayor Van Wyck and Seth Low, and a reply by President Woodward.

In the afternoon, five only of the nine vice-presidents will deliver their annual addresses, the others being deferred till next year under the recent amendment to the by-laws.

These addresses are: At 3 o'clock, in Room 301, Fayerweather Hall, by Prof. Asaph Hall, Jr., of Ann Arbor, Mich., before the Section of Mathematics and Astronomy. In Room 309, Havemeyer Hall, by Prof. James L. Howe, of Washington and Lee University, Virginia, before the Section of Chemistry, and in Room 502, Schermerhorn Hall, by Prof. William Trelease, of Shaw Botanic Gardens, St. Louis, Mo., before the Section of Botany.

At 4 o'clock vice-presidential addresses will be delivered in Room 301, Havemeyer Hall, by Prof. Ernest Merritt, of Cornell, before the Section in Physics; and in Room 401, Schermerhorn Hall, by Prof. James F. Kemp, of Columbia, before the Section of Geology and Geography.

The vice-president of the Section of Mechanical Science and Engineering is Prof. John A. Brashear, of the Western University of Pennsylvania, Allegheny, the well-known maker of scientific apparatus. The secretary is Prof. William T. Magruder, of Columbus, Ohio. The secretary of the Physics Section is Prof. R. A. Fessenden, of Allegheny, Pa. Papers will be read in these, as in other sections, beginning on Tuesday morning, June 26, and continuing morning and afternoon, till the following Friday, unless the programme shall be completed sooner.

The closing exercises of the meeting will be held on Friday evening, June 29.

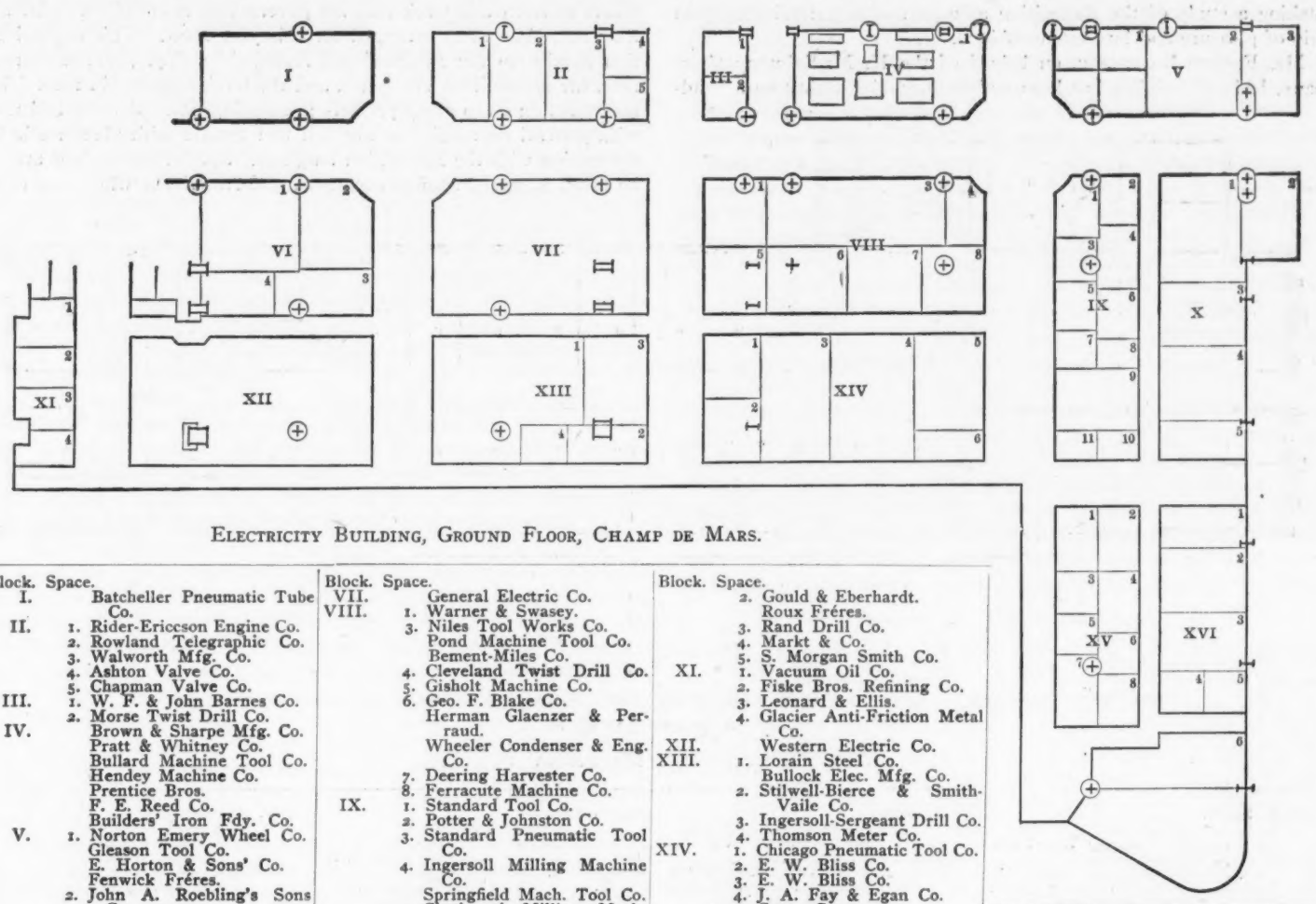
The arrangements for the meeting have been made by the local executive committee, of the following resident fellows of the association: Prof. John J. Stevenson, chairman; Prof. R. S. Woodward, president of the association; Prof. Wm. Hallock, secretary of the council; Prof. J. F. Kemp, vice-president, Section E; Prof. D. T. MacDougal, vice-president, Section G; Prof. N. L. Britton, chairman reception committee; Prof. Chas. F. Cox, chairman transportation committee; Prof. Henry F. Osborn; Prof. Frederick W. Putnam; Prof. Wm. McMurtrie, treasurer; Prof. J. M. Cattell, secretary.

The number of affiliated societies meeting with the association, or just before or after, is enlarged quite beyond all precedent. The preliminary programme enumerates the following: American Forestry Association, Chemical Society, Mathematical Society, Folk-Lore Society, Microscopical Society, Physical Society and Psychological Association, Geological Society of America, Botanical Society of America, Astronomical and Physical Society of America, Society for the Promotion of Agricultural Science, also of Engineering Education; Association of Economic Entomologists, Linnean Fern, and Sullivant Moss Chapters, and Sigma Xi Honorary Scientific Fraternity.

Of these, the Physical Society will hold joint sessions with Section B (Physics), of the A. A. A. S. Prof. Henry S. Rowland, of the Johns Hopkins University, Baltimore, Md., is president, and Prof. Ernest Merritt, of Cornell, is secretary. The Astronomical and Physical Society of America will hold joint sessions with Section A (Mathematics and Astronomy), of the A. A. A. S., probably on Thursday and Friday. Prof. Simon Newcomb, of Washington, is president, and Prof. Edwin B. Frost, of Williams Bay, Wis., is secretary. The Society for the Promotion of Engineering Education, instead of preceding the meeting of the A. A. A. S., will follow it on July 2, 3 and 4.

## Location of American Electrical and Mechanical Exhibits at the Paris Exposition.

THE diagrams shown on this and the next page will be of use in indicating the location of the largest electrical and mechanical exhibitors at the Paris Exposition in the two main exhibits—that on the Champ de Mars in Mechanics and Electricity Buildings, and that in the American Machinery Building and annexes at the Bois de Vincennes. A great many names appearing in the lists of exhibitors will not appear on the plans, for the reason that there are some grouped exhibits, as, for example, in the large "collective" display of electrical apparatus, wires, cables, insulators, trolleys, etc., made in Electricity Building. This is not on the ground floor, but in the gallery overlooking the foreign section of the power plant and not far from the American Court of Honor, which faces toward it




ELECTRICITY BUILDING, GROUND FLOOR, CHAMP DE MARS.

| Block. | Space. | |
|---|---|---|
| I. | | Batcheller Pneumatic Tube Co. |
| II. | 1. | Rider-Ericcson Engine Co. |
| | 2. | Rowland Telegraphic Co. |
| | 3. | Walworth Mfg. Co. |
| | 4. | Ashton Valve Co. |
| | 5. | Chapman Valve Co. |
| III. | 1. | W. F. & John Barnes Co. |
| | 2. | Morse Twist Drill Co. |
| IV. | | Brown & Sharpe Mfg. Co. |
| | | Pratt & Whitney Co. |
| | | Bullard Machine Tool Co. |
| | | Hendey Machine Co. |
| | | Prentice Bros. |
| | | F. E. Reed Co. |
| | | Builders' Iron Fdy. Co. |
| V. | 1. | Norton Emery Wheel Co. |
| | | Gleason Tool Co. |
| | | E. Horton & Sons' Co. |
| | | Fenwick Fréres. |
| | 2. | John A. Roebling's Sons Co. |
| | 3. | Chas. A Schieren & Co. |
| VI. | 1. | Tinius Olsen & Co. |
| | 2. | Simonds Mfg. Co. |
| | 3. | Thomas A. Edison. |
| | 4. | McGraw Publishing Co. |
| | | ELECTRICAL WORLD AND ENGINEER. |
| | | *Street Railway Journal.* |
| | | *American Electrician.* |

| Block. | Space. | |
|---|---|---|
| VII. | | General Electric Co. |
| VIII. | 1. | Warner & Swasey. |
| | 3. | Niles Tool Works Co. |
| | | Pond Machine Tool Co. |
| | | Bement-Miles Co. |
| | 4. | Cleveland Twist Drill Co. |
| | 5. | Gisholt Machine Co. |
| | 6. | Geo. F. Blake Co. |
| | | Herman Glaenzer & Perraud. |
| | | Wheeler Condenser & Eng. Co. |
| | 7. | Deering Harvester Co. |
| | 8. | Ferracute Machine Co. |
| IX. | 1. | Standard Tool Co. |
| | 2. | Potter & Johnston Co. |
| | 3. | Standard Pneumatic Tool Co. |
| | 4. | Ingersoll Milling Machine Co. |
| | | Springfield Mach. Tool Co. |
| | 5. | Cincinnati Milling Mach. Co. |
| | 6. | Bickford Drill & Tool Co. |
| | 7. | Landis Tool Co. |
| | 8. | Adolphe Janssens. |
| | 9. | Acme Machinery Co. |
| | | Flather & Co. |
| | 10. | American Machy. Co. |
| | 11. | L. S. Starrett Co. |
| X. | 1. | Tripler Liquid Air Co. |

| Block. | Space. | |
|---|---|---|
| | 2. | Gould & Eberhardt. |
| | | Roux Fréres. |
| | 3. | Rand Drill Co. |
| | 4. | Markt & Co. |
| | 5. | S. Morgan Smith Co. |
| XI. | 1. | Vacuum Oil Co. |
| | 2. | Fiske Bros. Refining Co. |
| | 3. | Leonard & Ellis. |
| | 4. | Glacier Anti-Friction Metal Co. |
| XII. | | Western Electric Co. |
| XIII. | 1. | Lorain Steel Co. |
| | | Bullock Elec. Mfg. Co. |
| | 2. | Stilwell-Bierce & Smith-Vaile Co. |
| | 3. | Ingersoll-Sergeant Drill Co. |
| | 4. | Thomson Meter Co. |
| XIV. | 1. | Chicago Pneumatic Tool Co. |
| | 2. | E. W. Bliss Co. |
| | 3. | E. W. Bliss Co. |
| | 4. | J. A. Fay & Egan Co. |
| | 5. | Crane Co. |
| | 6. | Neptune Meter Co. |
| XV. | 1. | Lunkenheimer Co. |
| | 2. | W. S. Doig. |
| | 3. | R. K. Le Blond Machine Tool Co. |
| | 4. | H. B. Smith Co. |
| | 5. | O. & C. Co. |
| | 6. | Morgan Machine Co. |
| | 7. | Rockwell Clough Co. |

| Block. | Space. | |
|---|---|---|
| | 8. | Fellows Gear Shaper Co. |
| | | Jones & Lamson Mach. Co. |
| XVI. | 1. | W. P. Healy. |
| | 2. | Directors' Office. |
| | 3. | S. R. Dresser. |
| | 4. | American Tool & Mach. Co. |
| | 5. | E. C. Atkins Co. |
| | 6. | Robins' Conveying Belt Co. |

acros the open space. For this collective exhibit a number of large, handsome cases in hard wood have been provided, and the effect is excellent. Other pieces and groups that are too bulky for the cases have been disposed along the space or on the walls.

## Paris Exposition Jurors.

The French Journal Officiel has just announced the names of the French jurors in a number of classes, including mechanics and electricity. The United States Commissioner-General has also announced his selections in the same classes. It may be stated that the American jurors have had to be chosen at very short notice, and it was not until the last moment that several well-known men could be notified, when many of them found it impossible to make their arrangements to come on or to stay the required length of time in Paris.

Group 4 is mechanical apparatus and appliances. Class 19 in it is steam engines, and the French jurors are: Debize, Fauquier, Filpot, Garnier, Guyot-Sionnest, Hirsch, Liebaut, Michel-Levy, Roser, Sauvage and Walckenaer. The United States juror is C. Le Blanc. The French alternates are Compère and Dorel. United States of America, none. Class 20—Various motors. French jurors: Firminhac, Jules Le Blanc, Singrün, Worms de Romilly. Alternates: Brulé and Wehrlin. United States of America, no juror. Class 21—General mechanical apparatus. Bourdon, Domange, Léauté, Masson, Perissé, Richemond. Alternates: Hamelle, Parenty, Roger. United States juror: Prof. Storm Bull. No alternate. Class 22—Machine tools. Bariquand, Duval-Pihet, Guilliet, Haret, son, Maréchal, Masselon, Poulot, Tresca. United States jurors: F. E. Drake and Hart O. Berg.

Group 5 is electricity. Class 23—Machines and appliances for producing and utilizing electricity. French jurors: Auvert, Berdin, Hillairet, Hospitalier, Javaux, Mascart, Monnier-Demetrius, Postel-Vinay, Raclet, Sciama. Alternates: Lombard-Gerin and Maiche. United States jurors: W. D. Ball. C. T. Malcolmson alternate. Class 24—Electro-chemistry. Bancelin, Becquerel, Bouty, Moissan. Alternates: Etard and Street. United States juror: George R. Ostheimer. Class 25—Electric lighting. Cance, Ebel, Fontaine, Janet, Josse, Martine, Meyer, Violle. Alternates: Miet, Roux, Sonbeyran. United States juror: Carl Hering. Class 26—Telegraphy and telephony. Darcq, Mercadier, Pillivuyt, Seligmann-Lui, Weiller, Willot, Wunschendorf. Alternates: De Nansouty and de Nerville. United States juror: J. S. Anthony. Class 27—Various applications of Electricity. D'Arsonval, Bergonie, Chaperon, Dumont, Gaiffe, son, Sartiaux. Alternate: Imbert. United States juror: Richard Varley.

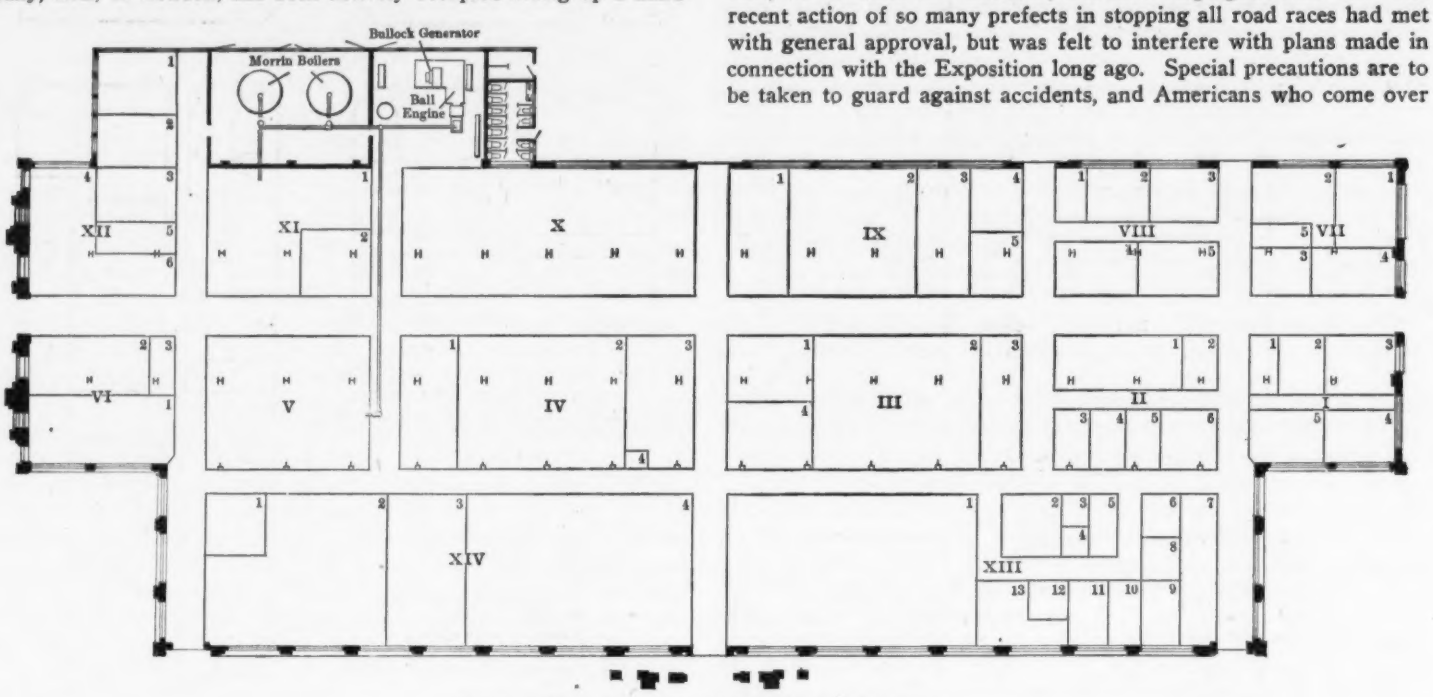
There is of course a whole set of rules and regulations applying to jurors and their work. Awards are divided into diplomas of grand prize, gold medal, silver medal, bronze medal and honorable men-

tion. There are three degrees of jurisdiction, juries of class, juries of group and a high jury. For all the classes, the total number of French or foreign appointed jurors is to be about one-sixtieth of the number of exhibitors. The total number of French or foreign substitute members is not to exceed one-third of the number of appointed jurors. Exhibitors serving as jurors are placed out of competition, if a private concern, but public departments may compete for awards even if one of their officers is a juror. After the lower juries have done their work, the high jury is to examine the lists and decide without appeal by order of merit, the awards to be made. It is proposed to have all this work done so that the solemn distribution of awards may take place not later than the beginning of September, when the French Government will also publish the official list.

### EXPOSITION NOTES.

MR. C. W. HOLTZER, president of the Holtzer-Cabot Electric Company, of Boston, was a visitor in Paris during the last week of May, making a study of the Exposition as a part of a general European trip of pleasure and business combined.

MR. ERNEST ROSENBERG, on behalf of the H. M. Salmony Company, Ltd., of London, has been actively occupied fitting up a hand-




VINCENNES AMERICAN MACHINERY BUILDING.

| Block. | Space. | |
|---|---|---|
| I. | 1. | L. S. Starrett Co. |
| | 2. | Norton Emery Wheel Co. |
| | 3. | Fenwick Bros. |
| | 4. | Fenwick Bros. |
| | 5. | Builders' Iron Foundry Co. |
| II. | 1. | Gisholt Machine Co. |
| | 2. | American Machinery Co. |
| | 3. | Gleason Tool Co. |
| | 4. | W. F. & John Barnes Co. |
| | 5. | Reeves Pulley Co. |
| | 6. | Fiske Bros. Refining Co. |
| III. | 1. | Prentice Bros. |
| | 2. | Brown & Sharpe Mfg. Co. |
| | 3. | F. E. Reed Co. |
| | 4. | Hendey Machine Co. |
| IV. | 1. | Warner & Swasey. |
| | 2. | Pratt & Whitney. |
| | 3. | Bullard Mach. Tool Co. |
| | 4. | Morse Twist Drill Co. |
| V. | | Ingersoll-Sergeant Drill Co. |
| VI. | 1. | H. B. Smith Co. |
| | 2. | Fellows Gear Shaper Co. |
| | | Jones & Lamson Mach. Co. |
| | 3. | Gould & Eberhardt. |
| VII. | 1. | Directors' Office. |
| | 2. | Directors' Office. |
| | 3. | Ingersoll Milling Mch. Co. |
| | 4. | Acme Machinery Co. |
| | 5. | Simonds Mfg. Co. |
| VIII. | 1. | Standard Pneumatic Tool Co. |
| | 2. | Becker-Brainard M. M. Co. |
| | 3. | Flather & Co. |
| | 4. | Cincinnati Milling Mch. Co. |
| | 5. | Ferracute Machine Co. |
| IX. | 1. | Chicago Pneumatic Tool Co. |
| | 2. | Markt & Co. |
| | 3. | Adolphe Janssens. |
| | 4. | American Tool & Mach. Co. |
| | 5. | Landis Tool Co. |
| X. | | Niles Tool Works Co. |
| | | Pond Machine Tool Co. |
| | | Bement-Miles Co. |
| XI. | 1. | Rand Drill Co. |
| | 2. | Jeffrey Mfg. Co. |
| XII. | 1. | Charging Station. |
| | 2. | R. K. Le Blond Machine Tool Co. |
| | 3. | O. & C. Co. |
| | 4. | Bethlehem Steel Co. |
| | 5. | Vacuum Oil Co. |
| | 6. | M. C. Bullock Mfg. Co. |
| XIII. | 1. | Indo-Egyptian Compress Co. |
| | 2. | Becker-Brainard M. M. Co. |
| | 3. | Baker Bros. |
| | 4. | Baker Bros. |
| | 5. | Baker Bros. |
| | 6. | Mossberg & Granville Mfg. Co. |
| | 7. | Springfield Mach. Tool Co. |
| | 8. | Springfield Machy. Co. |
| | 9. | New Haven Mach. Tool Co. |
| | 10. | W. S. Doig. |
| | 11. | Rice Gear Co. |
| | 12. | Leonard & Ellis. |
| | 13. | Berlin Iron Bridge Co. |
| XIV. | 1. | Sussfeld, Lorsch & Co. |
| | 2. | E. W. Bliss Co. |
| | 3. | De Friese & Co. |
| | 4. | J. A. Fay & Egan Co. |

some exhibit for the Helios-Upton Company in the United States collective electrical exhibit in the gallery, and has made an attractive display of their well-known arc lamps, etc.

GETTING READY. Having finally secured all their cases and material, the General Electric Company and the Western Electric Company are both expending every energy to put their spaces in shape, and hope to be in full, smooth running order before the middle of June, if they can get current by that time. Mr. Oolgaardt, for the General Electric company, is setting up a huge model of their factories, lit from below interiorly as well as above, and protected by a railing and canopy. There are also easels for large, typical photographs. Mr. J. M. Hollister, for the Western Electric Company, has laid out a most comprehensive exhibit of apparatus in all classes of electrical application, including a lot of direct and alternating-current arc lamps, several motors, a complete generating plant driven by motors of 75-kw capacity, a complete set of telephonic apparatus, including a common-battery system in operation; fan motors, all kinds of telegraph and signaling apparatus, and two large plaster models of the New York and Chicago factories.

ATTENDANCE. The attendance at the Exposition is growing with a rapidity which is the more remarkable when one regards the very backward condition of so much of the buildings and their contents. On Sunday, May 20, it reached over 340,000. On the following Thursday it was over 300,000, and on Sunday, May 27, it went over 400,000. Such results are very satisfactory and encouraging to the management and the government. On the last Sunday night most of those present crowded into the Champ de Mars to see the partial illumination, while during the day nearly 100,000 of them patronized the moving sidewalk, whose electrical apparatus continues to work with amazing ease and efficiency.

AUTOMOBILISM. It has afforded pleasure to a great many automobilists to learn this week that the government has decided to let all the automobile races arranged for this year stand. This authorization applies to the International Automobile Cup, the Paris-Brest race, the Eventail de Vincennes, and the Draignignan-Aix race. The recent action of so many prefects in stopping all road races had met with general approval, but was felt to interfere with plans made in connection with the Exposition long ago. Special precautions are to be taken to guard against accidents, and Americans who come over for these events can confidently count on seeing some pretty fast work.

ELECTRICIANS AT THE SHOW. Just as foreign electrical engineers propose to rendezvous at the Exposition, so the French engineers have already adopted the practice. The Association Amicale des Ingenieurs Electriciens had its first reunion at the Champ de Mars on May 29, when some sixty or seventy well-known members met at one of the restaurants near the Chateau d'Eau, under the presidency of Mr. E. Sartiaux, among those present being engineers, manufacturers, editors, exhibitors, etc., and one of the guests being the editor of the ELECTRICAL WORLD AND ENGINEER. A most enjoyable time was spent at dejuener, after which an inspection was made of the plant, exhibits, etc. These meetings will in all probability be continued twice a month while the show is open.

CATALOGUES. Bit by bit the official catalogue is making its ap-

pearance, but the sections in electricity, mechanics, transportation, etc., have not yet been reached. One can get a lot of information about fine arts, or education, or agriculture, but the issuance of the other sections will not take place, it is said, for at least two or three weeks. So those who wander through the Palace of Electricity searching for specific exhibits and inquiring as to the names of others, have to possess their souls in patience.

TRANSPORTATION JURORS. The United States jurors appointed in Group 6, civil engineering and transportation, are as follows: Class 28—Machinery, apparatus and appliances of civil engineering, J. A. Ockerson and Corydon T. Purdy. Class 29—Models, plans and designs of public works, Louis A. Risse. Class 30—Carriage building and wheelwrights' work (vehicles other than those used on tracks). Maj. J. W. Howard (vice-president of class). Class 32—Railway and tramway materials, William Renshaw, engineer, Illinois Central Railroad, and Prof. G. S. Wilkins, civil engineering department of the University of Alabama. The various jury bodies are now beginning to organize.

SUNDAY OPENING. The question of Sunday opening at Vincennes has come up in pronounced form the past week, and by a vote of a large majority of the space, the manufacturers represented in the American Machinery Building have decided to have their exhibits open and running on the day which is the one where most people attend. It is the fact, moreover, that the Bois de Vincennes is near the homes of a large part of the working population of Paris, who must see this exhibit on Sunday, or never at all; and the French authorities, as well as the American, have felt it to be a hardship to deny this intelligent class such an opportunity to study fine machines and tools of the latest type. Director Drake therefore put the matter to the vote, and the building will hereafter be open Sunday with, it is generally believed, a most marked improvement in the Sunday attendance at the Vincennes section.

U. S. ELECTRICAL SECTION. "Openings" are happily now very much the fashion. It had been the intention of Mr. Drake to open the United States Electrical Sections on the Champ de Mars on June 2, Saturday, but the belated arrival of some material and exhibits has caused a postponement until June 6, when it is believed that everything will be in place, if not exactly in its finest feather.

WALWORTH MANUFACTURING COMPANY, of Boston, has a fine exhibit of its bronze seat gate valves, joints, pipe bending, etc., in a massive ebony and plate glass case, on the ground floor of Electricity Building, just in the rear of the Chateau d'Eau, and opposite the main alternating-current switchboard. The exhibit was "dedicated" to the public on May 28, by Col. G. T. Coppins, secretary of the company, with a pleasing ceremony, which included several items more familiar to American palates on the western side of the Atlantic than in Paris. Commissioner-General Peck and several members of his staff participated. The material shown is already in demand in Europe, and it is said that the exhibit will be bodily transported next year to Russia.

ORGANIZING THE PARIS EXPOSITION JURIES. The jury work of Group V., electricity, is now in hand and the organization has been effected as given below: Class 23—Mechanical production and utilization of electricity. President, M. Turretini; vice-president, M. Monnier; reporter, M. Hospitalier; secretary, M. Hillairet. Class 24—Electro-chemistry. President, M. Moissan; vice-president, M. Eric Gerard (Belgium); reporter, M. Becquerel; secretary, M. Etard. Class 25—Electric lighting. President, M. Fontaine; vice-president, M. Carl Hering; reporter, M. Paul Janet; secretary, M. Josse. Class 26—Telegraphy and telephony. President, M. Raymond; vice-president, M. Kolvig (Denmark); reporter, M. Seligman-Lui; secretary, M. Max de Nansouty. Class 27—Miscellaneous applications of Electricity. President, M. d'Arsonval; vice-president, M. Hartmann (Germany); reporter, M. Chaperon; secretary, M. Sartiaux.

## Bell Telephone Expansion.

A conference of telephone officials was recently held in Boston for the purpose, it is reported, of devising means for an extensive development in the various territories of the companies represented. It is stated that $3,000,000 will be expended within the next six months in the Central Union territory, comprising Ohio, Indiana and Iowa; $3,000,000 in the Erie territory and $1,000,000 in the Missouri and Kansas Company's territory.

## The Electrical and Mechanical Exhibits at the Paris Exposition.

SUBJECT to late revision, but appearing with official approval and corrections, the following are the names of the exhibitors from the United States in the two great groups of Mechanics and Electricity. As will have already been gathered from the previous articles in this journal on the subject, these exhibits are divided up between the two parts of the Exposition, the bulk of the mechanical exhibits appearing in the separate American Machinery Building in the Bois de Vincennes. Several of the exhibitors appear in more than one group. Another point to be borne in mind, is that, impressive as the showing is of so many hundred American firms seeking foreign trade in this manner, a large number of such concerns are already represented by distinctive foreign houses and factories, so that their goods or apparatus appear in foreign sections. The manner in which American technical influences thus pervade the Exposition in nearly all departments is not a little remarkable.

There is a good deal of satisfaction on the whole as to the admirable representation thus made of electrical and mechanical applications from the United States, but still one hears regrets as to the inadequacy in certain departments, as for instance textile machinery and also such as musical instruments, which, after all, must be regarded as mechanism. Another regret frequently heard is that no large American engines or dynamos are to be found in the Exposition. This is a true criticism, but again misleading, for some of the largest units are American in every sense, except as to locality of production. Besides, it is obvious that to bring a 5000-hp unit across the Atlantic, not on order, merely for show, or to use it to furnish current for the authorities at a price that would not pay even the freight, would be a decided piece of commercial quixotism.

In addition to the showing thus made in the Exposition proper, there are the great Worthington pumping station with its 40 million gallons daily capacity; the moving sidewalk and third-rail road run by Westinghouse motors, and the sub-station furnishing the current for those means of transportation through the largest induction motors ever built also hailing from the same factory in the United States. All told, American mechanics and engineers have no reason to be ashamed of the showing made by their country in Paris in 1900, in mechanics, in electricity and in transportation, agriculture, etc.

UNITED STATES MECHANICS.—GROUP IV.

CLASS 19.—GENERAL MATERIALS AND PROCESSES OF MECHANICS.

Advance Packing & Supply Co., Chicago, Ill.
Ambler Asbestos Air Cell Covering Co., New York.
American Fire Engine Co., Seneca Falls, N. Y.
American Injector Co., Detroit, Mich.
American Steam Gauge Co., Boston, Mass.
American Steam Packing Co., Boston, Mass.
Ashton Valve Co., Boston, Mass.
Ball Engine Co., Erie, Pa.
Geo. F. Blake Mfg. Co., New York.
Bowen Mfg. Co., Auburn, N. Y.
J. F. Brady, Chicago, Ill.
Brandt, Randolph, New York.
Burt Mfg. Co., Akron, Ohio.
Canfield Mfg. Co., Philadelphia, Pa.
Chesterton, A. W., & Co., Boston, Mass.
Cleveland Rubber Works, Cleveland, Ohio.
Clonbrock Steam Boiler Co., Brooklyn, N. Y.
Coale Muffler & Safety Valve Co., Baltimore, Md.
Crandall Packing Co., Palmyra, N. Y.
Crane Co., Chicago, Ill.
Crosby Steam Gage & Valve Co., Boston, Mass.
De Rycke, Joseph, New York.
D'Este & Seeley Co., Boston, Mass.
Detroit Lubricator Co., Detroit, Mich.
Direct Separator Co., Syracuse, N. Y.
Eagle Oil & Supply Co., Boston, Mass.
Fiske Bros. Refining Co., New York.
Forbes, W. D., & Co., Hoboken, N. J.
Ford, Thos. P., New York.
Fort Wayne Safety Valve Co., Fort Wayne, Ind.
Foster Engin'g Co., Newark, N. J.
Galvanic Metal Paper Co., New York.
Goodsell Packing Co., Chicago.
Dixon, Jos., Crucible Co., Jersey City, N. J.
Hayden & Derby Mfg. Co., New York.
Higbee Joint Co., Philadelphia, Pa.
Homestead Valve Mfg. Co., Homestead, Pa.
Hoyt Metal Co., St. Louis, Mo.
Hubbard & Co., Buffalo, N. Y.
Ingersoll-Sergeant Drill Co., New York.
Johns, H. W., Mfg. Co., New York.
Kennedy Valve Mfg. Co., New York.
Keystone Engineering & Mfg. Co., Philadelphia, Pa.
Lackawanna Lubricator & Mfg. Co., Scranton, Pa.
Lea Injector Mfg. Co., Detroit, Mich.
Leonard & Ellis, New York.
Locke Regulator Co., Salem, Mass.
Lunkenheimer Co., Cincinnati, Ohio.
Mabbs Hydraulic Packing Co., Chicago, Ill.
McDondland, G. T., Brooklyn, N. Y.
Manzel Bros., Buffalo, N. Y.
Mosher, Charles D., New York.
Nathan Mfg. Co., New York.
National Injector Co., Cleveland, O.
New Bedford Boiler & Machine Co., New Bedford, Mass.
New Jersey Car Spring & Rubber Co., Jersey City, N. J.
Oil Well Supply Co., Pittsburg, Pa.
Orvis & Hawkes, Chicago, Ill.
Peerless Rubber Mfg. Co., New York.
Penberthy Injector Co., Detroit, Mich.
Phœnix Metallic Packing Co., Chicago, Ill.
Phœnix Steam Packing Co., New York.
Pittsburg Steam Jacket Lubricating Co., Pittsburg, Pa.
Powell, William, Co., Cincinnati, O.
Reid Mfg. Co., Erie, Pa.
Reliance Gauge Column Co., Philadelphia, Pa.
Restein, Clement & Co., Philadelphia, Pa.
Robins Conveying Belt Co., New York.
Schaffer & Budenberg, Brooklyn, N. Y.
Sellars, Wm., Co., Philadelphia, Pa.
Sherwood Mfg. Co., Buffalo, N. Y.
Smoothon Mfg. Co., Jersey City, N. J.
Taunton Locomotive Mfg. Co., Taunton, Mass.
U. S. Metallic Packing Co., Philadelphia, Pa.
Vacuum Oil Co., Rochester, N. Y.
Walsh Packing Co., Philadelphia, Pa.
Walworth Mfg. Co., Boston, Mass.
Watson, N. A., Erie, Pa.
Watts, John M., Sons, New York.
Wheeler Condenser & Engineering Co., New York.
Whitfield Co., Memphis, Tenn.
Wilkinson, A. J., & Co., Boston, Mass.

Winkley, F. D., Madison, Wis.

CLASS 20.—MOTIVE POWER MECHANISM.

Ingersoll-Sergeant Drill Co., New York.
Mietz & Weiss, New York.
Pelton Water Wheel Co., San Francisco, Cal.
Rider-Ericsson Engine Co., New York.
Smith, S. Morgan, Co., York, Pa.

CLASS 21.—VARIOUS MECHANICAL APPARATUS.

Allington & Curtis Co., Chicago, Ill.
American Fire Engine Co., Seneca Falls, N. Y.
Ashcroft Mfg. Co., New York.
Batcheller Pneumatic Tube Co., New York.
Bilgram, Hugo, Philadelphia, Pa.
Boston Belting Co., Boston, Mass.
Bristol Co., Waterbury, Conn.
Chapman Valve Mfg. Co., Indian Orchard, Mass.
Chicago Raw Hide Mfg. Co., Chicago.
Christensen Engineering Co., Milwaukee, Wis.
Cleveland Gear Works, Cleveland, O.
Cleveland Rubber Works, Cleveland, O.
Crane Co., Chicago, Ill.
Cresson, Geo. V., Co., Phila., Pa.
Crosby Steam Gage & Valve Co., Boston, Mass.
Dresser, S. R., Bradford, Pa.
Durant, Walter N., Milwaukee, Wis.
Fire Extinguisher Mfg. Co., Chicago.
Fisher Governor Co., Marshalltown, Ia.
Ford, Thomas P., New York.
Graber, H. S., St. Louis, Mo.
Greenwood, Oliver K., Baltimore, Md.
Harris & Baldwin, Jamestown, N. Y.
Henderer's, A. L., Sons, Wilmington, Del.
Hollands Mfg. Co., Erie, Pa.
Hornsburgh & Scott, Cleveland, Ohio.
Hoyt Metal Co., St. Louis, Mo.
Ingersoll-Sergeant Drill Co., New York.
Jeffrey Mfg. Co., Columbus, Ohio.
Kennedy Valve Mfg. Co., New York.
Lippincott Steam Specialty Co., New York.
Locke Regulator Co., Salem, Mass.
Ludlow Valve Mfg. Co., New York.
Mabbs Hydraulic Packing Co., Chicago.
Monarch Fire Appliance Co., New York.
Monarch Governor & Machine Co., Indianapolis, Ind.
Monarch Mfg. Co., Waterbury, Conn.
Neptune Meter Co., New York.
New Process Raw Hide Co., Syracuse, N. Y.
Oil Well Supply Co., Pittsburg, Pa.
Olsen, Tinius, & Co., Philadelphia, Pa.
Rand Drill Co., New York.
Reeves Pulley Co., Columbus, Ohio.
Rice Gear Co., Hartford, Conn.
Robins Conveying Belt Co., New York.
Roots, P. H. & F. M., Co., Connersville, Ind.
Saunder's, D., Sons, Yonkers, N. Y.
Stow Mfg. Co., Binghamton, N. Y.
Schaffer & Budenberg, Brooklyn, N. Y.
Schieren, Chas. A., & Co., New York.
Silverman, Lazarus, Chicago.
Stilwell-Bierce & Smith-Vaile Co., Dayton, Ohio.
Stuart, Robert J., New Hamburg, N. Y.
Stuart, R. J., Foundry & Machine Works, New Hamburg, N. Y.
Sturtevant, B. F., Co., Boston, Mass.
Tabor Mfg. Co., Elizabeth, N. J.
Thomson Meter Co., Brooklyn, N. Y.
Tight Joint Co., New York.
Torrey, H. S., New York.
Trautvetter Bros., Paterson, N. J.
Tripler Liquid Air Co., New York.
Tyler, W. S., & Co., Cleveland, Ohio.
Vacuum Oil Co., Rochester, N. Y.
Walworth Mfg. Co., Boston, Mass.
Watson-Stillman Co., New York.
Worthington Pumping Engine Co., New York.

CLASS 22.—MACHINE TOOLS.

Acme Machinery Co., Cleveland, O.
Almond, T. R., Brooklyn, N. Y.
American Machinery Co., Grand Rapids, Mich.
American Tool & Machine Co., Boston, Mass.
American Turret Lathe Co., Wilmington, Del.
Armstrong Bros. Tool Co., Chicago.
Atkins, E. C., & Co., Indianapolis, Ind.
Baker Bros., Toledo, Ohio.
Barnes, W. F. & John, Co., Rockford, Ill.
Bates Machine Co., Joliet, Ill.
Becker-Brainard Milling Machine Co., Hyde Park, Mass.
Bethlehem Steel Co., Bethlehem, Pa.
Bliss, E. W., Co., Brooklyn, N. Y.
Becker, John, Fitchburg, Mass.
Bement-Miles Co., Philadelphia, Pa.
Bickford Drill & Tool Co., Cincinnati, Ohio.
Bowsher, N. P., South Bend, Ind.
Bradford Mill Co., Cincinnati, Ohio.
Bridgeport Gun Implement Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Brown, R. H., & Co., New Haven, Conn.
Buffalo Forge Co., Buffalo, N. Y.
Builders' Iron Foundry, Providence, R. I.
Bullard Machine Tool Co., Bridgeport, Conn.
Burr, John T., & Son, Brooklyn, N. Y
Carborundum Co., Niagara Falls, N.Y.
Card, S. W., Mfg. Co., Mansfield, Mass.
Carpenter, J. M., Tap & Die Co., Pawtucket, R. I.
Cataract Tool & Optical Co., Buffalo, N. Y.
Chicago Pneumatic Tool Co., Chicago, Ill.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Cleveland Twist Drill Co., Cleveland, Ohio.
Clough, R. H., Tolland, Conn.
Clough, Rockwell, Co., Alton, N. H.
Coes, L., Wrench Co., Worcester, Mass.
Coffin & Leighton, Syracuse, N. Y.
Curtis & Curtis, Bridgeport, Conn.
Cushman Chuck Co., Hartford, Conn.
D'Armour & Littledale Machine Co., New York.
Deering Harvester Co., Chicago, Ill.
Dock, Herman, Philadelphia, Pa.
Doig, W. S., Brooklyn, N. Y.
Eames, Wilfred, Co., Rochester, N. Y.
Errington, F. A., New York.
Fay, J. A., & Egan Co., Cincinnati, O.
Fellows Gear Shaper Co., Springfield, Vt.
Ferracute Machine Co., Bridgeton, N. J.
Fosdick & Hollway Machine Tool Co., Cincinnati, Ohio.
Flather & Co., Nashua, N. H.
Flather Planer Co., Nashua, N. H.
Foster, W. H., New York.
Gay & Ward, Athol, Mass.
Geometric Drill Co., Westville, Conn.
Gibson, A. C., Buffalo, N. Y.
Gisholt Machine Co., Madison, Wis.
Gleason Tool Co., Rochester, N. Y.
Goodell-Pratt Co., Greenfield, Mass.
Gorton, Geo., Machine Co., Racine, Wis.
Grant Machine Tool Works, Cleveland, Ohio.
Hampden Corundum Wheel Co., Brightwood, Mass.
Hardinge Bros., Chicago, Ill.
Hart Mfg. Co., Cleveland, Ohio.
Healy, Wm. P., Chicago, Ill.
Hendey Machine Co., Torrington, Conn.
Higginbottom-Davis Journal & Alarm System, Chicago.
Hilles & Jones Co., Wilmington, Del.
Hill, Hugh, Tool Co., Anderson, Ind.
Hoggson & Pettis Mfg. Co., New Haven, Conn.
Hollands Mfg. Co., Erie, Pa.
Horton, E., & Son Co., Windsor Locks, Conn.
Ingersoll Milling Machine Co., Rockford, Ill.
Jones & Lamson Machine Co., Springfield, Vt.
Kearney & Foote, New York.
Landis Tool Co., Waynesboro, Pa.
Le Blond, R. K., Machine Tool Co., Cincinnati, Ohio.
Le Count, Wm. G., South Norwalk, Conn.
Deland & Faulconner Mfg. Co., Detroit, Mich.
Leisenring, John, Mfg. Co., Philadelphia, Pa.
Lidell & Williams, Chicago.
Lucas, J. L., Providence, R. I.
Markt & Co., New York.
Meadville Vise Co., Meadville, Pa.
Merchants' Mfg. Co., Boston, Mass.
Morgan Machine Co., Rochester, N.Y.
Morse Twist Drill & Machine Co., Muskegon Heights, Mich.
Mossberg & Granville Mfg. Co., Providence, R. I.
New Haven Mfg. Co., New Haven, Conn.
New Process Twist Drill Co., Taunton, Mass.
Nicholson, W. H., & Co., Wilkesbarre, Pa.
Niles Tool Works Co., Hamilton, O.
Norton Emery Wheel Co., Worcester, Mass.
Oesterlein Machine Co., Cincinnati, O.
Oneida National Chuck Co., Oneida, N. Y.
Oster Mfg. Co., Cleveland, Ohio.
Pearson Machine Co., Chicago, Ill.
Pond Machine Tool Co., Plainfield, N. J.
Potter & Johnston Co., Pawtucket, R. I.
Pratt & Whitney Co., Hartford, Conn.
Pratt Chuck Co., Frankfort, N. Y.
Prentice Bros. Co., Worcester, Mass.
Prentiss Vise Co. New York.
O. & C. Co., Chicago, Ill.
Quint, A. D., Hartford, Conn.
Ransom, Perry, Oshkosh, Wis.
Reece, E. F., Co., Greenfield, Mass.
Reed, F. E., Co., Worcester, Mass.
Rice Gear Co., Hartford, Conn.
Richardson, C. F., & Son, Athol, Mass.
Rivett-Dock Co., Brighton, Mass.
Rogers, J. M., Boat, Gauge & Drill Works, Gloucester City, N. J.
Sackman, F. A., Cleveland, Ohio.
Safety Emery Wheel Co., Springfield, Ohio.
St. Louis Machine Tool Co., St. Louis, Mo.
Saunders', D., Sons, Yonkers, N. Y.
Saw Co., New York.
Sawyer Tool Co., Fitchburg, Mass.
Simons Mfg. Co., Fitchburg, Mass.
Skinner Chuck Co., New Britain, Conn.
Slocomb, J. T., & Co., Providence, R. I.
Smith, H. B., Machine Co., Smithville, N. J.
Springfield Machine Tool Co., Springfield, Ohio.
Springfield Mfg. Co., Providence, R. I.
Standard Pneumatic Tool Co., Chicago, Ill.
Starret, L. S., Co., Athol, Mass.
Stiles & Parker Press Co., Brooklyn, N. Y.
Sussfield, Lorsch & Co., New York.
Thompson, Henry G., & Son Co., New Haven, Conn.
T. & B. Tool Co., New Bedford, Mass.
Tremont Mfg. Co., Roxbury, Mass.
Trump Bros. Machine Co., Wilmington, Del.
Union Mfg. Co., New Britain, Conn.
Vanderbeek Tool Works, Hartford, Conn.
Vitrified Wheel Co., Westfield, Mass.
Walker & Co., Worcester, Mass.
Waltham Watch Tool Co., Springfield, Mass.
Warner & Swasey, Cleveland, Ohio.
Waterbury Tool Co., Waterbury, Conn.
Watson-Stillman Co., New York.
Wells Bros. & Co., Greenfield, Mass.
Westcott Chuck Co., Oneida, N. Y.
Western Mfg. Co., Springfield, Ohio.
Weston, Thomas A., New York.
Whiton, D. E., Machine Co., New London, Conn.
Williams, David, Co., New York.
Wilmarth & Morman Co., Grand Rapids, Mich.
Washburn Shops of the Worcester Polytechnic Institute, Worcester, Mass.
Walcott, Geo. D., & Son, Jackson, Mich.

CLASS 23.—MECHANICAL PRODUCTION AND UTILIZATION OF ELECTRICITY.

Acheson, E. G., Niagara Falls, N. Y.
Advance Packing & Supply Co., Chicago, Ill.
Anderson, Albert & J. M., Mfg. Co., Boston, Mass.
American Commercial Rubber Co., Elizabeth, N. J.
American Hard Fibre Co., New York.
American Vitrified Conduit Co., New York.
American Woven Wire Brush Co., Peabody, Mass.
Anchor Electric Co., Boston, Mass.
Automatic Switch Co., Baltimore, Md.
Bates, D. L., & Bro., Dayton, Ohio.
Belknap Motor Co., Portland, Me.
Billings & Spencer Co., Hartford, Conn.
Bossert Electric Construction Co., Utica, N. Y.
Bullock Electric Mfg. Co., Cincinnati, Ohio.
C & C Electric Co., Garwood, N. J.
Central Union Brass Co., St. Louis, Mo.
Chase-Shawmut Co., Boston, Mass.
Chicago Raw Hide Mfg. Co., Chicago.
American Circular Loom Co., Boston, Mass.
Clark, James, Jr., & Co., Louisville, Ky.
Cleveland Electric Co., Cleveland, O.
Commercial Electric Co., Indianapolis, Ind.
Cook Mercantile Trust Co., Philadelphia, Pa.
Crocker-Wheeler Co., New York.
Crouse-Hinds Electric Co., Syracuse, N. Y.
Crown Woven Wire Brush Co., Salem, Mass.
Cutter Electrical & Mfg. Co., Philadelphia, Pa.
Dayton Electrical Mfg. Co., Dayton, Ohio.
Delaware Hard Fibre Co., Wilmington, Del.
Diehl Mfg. Co., Elizabethport, N. J.
Dixon, Joseph, Crucible Co., Jersey City, N. J.
Eck Dynamo & Motor Works, Newark, N. J.
Edison Mfg. Co., Orange, N. J.
Emerson Electric Mfg. Co., St. Louis, Mo.
Empire China Works, Brooklyn, N. Y.
Eureka Tempered Copper Works, North East, Pa.
Fagan, J. C., Watertown, N. Y.
Falcon Electric Mfg. Co., New York.
Falk Co., Milwaukee, Wis.
Fisher Electric Mfg. Co., Detroit, Mich.
Forest City Electric Co., Cleveland, O.
Galvanic Metal Paper Co., New York.
Garton-Daniels Co., Keokuk, Ia.
General Equipment Co., Camden, N. J.
Hartwig & Miller, Detroit, Mich.
Hazard Mfg. Co., Wilkesbarre, Pa.
Hobart Electric Mfg. Co., Troy, Ohio.
Holmes Fibre-Graphite Co., Germantown, Philadelphia, Pa.
Holtzer-Cabot Electric Co., Brookline, Mass.
Insulating Saddle Staple Co., Brockton, Mass.
Iron Clad Resistance Co., Westfield, N. J.
Jeffrey Mfg. Co., Columbus, Ohio.
Jenney Electric Mfg. Co., Indianapolis, Ind.
Johns, H. W., Mfg. Co., New York.
K. & W. Co., Pittsfield, Mass.
Kartavert Mfg. Co., Wilmington, Del.
Kester Electric Mfg. Co., Chicago.
Klein, Mathias, & Son, Chicago, Ill.
LaKon Transformer Co., Elkhart, Ind.
La Roche, F. A., & Co., New York.
Leonard, Ward, Electric Co., Bronxville, N. Y.
Locke, Fred M., Victor, N. Y.
Lorain Steel Co. Lorain, Ohio.
Manhattan Electrical Supply Co., New York.
Marshall, William, New York.
Milwaukee Electric Co., Milwaukee, Wis.
Munsell, Eugene, & Co., New York.
National Conduit & Cable Co., New York.
New Process Raw Hide Co., Syracuse, N. Y.
New York & Ohio Co., Warren, Ohio.
New York Insulated Wire Co., New York.
Ohio Electric Specialty Co., Troy, N. Y.
Okonite Co., New York.
Onondaga Dynamo Co., Syracuse, N. Y.
Otis Elevator Co., New York.
Partrick, Carter & Wilkins, Philadelphia, Pa.
Patridge Carbon Works, Sandusky, Ohio.
Phœnix Battery Mfg. Co., St. Louis, Mo.
Philadelphia Electrical & Mfg. Co., Philadelphia, Pa.
Pittsburg Transformer Co., Pittsburg, Pa.
Robbins & Myers Co., Springfield, O.
Royal Electric Co., Peoria, Ill.
Shaw Electric Crane Co., Muskegon, Mich.
Silex Insulation Co., New York.
Sills, W. H., Mica Co., Chicago.
Speer Carbon Co., St. Marys, Pa.
Sprague Electric Co., New York.
Standard Paint Co., New York.
Steward, D. M., Mfg. Co., Chattanooga, Tenn.
Stow Mfg. Co., Binghamton, N. Y.
Tesla, Nikola, New York.
Thomas, R., & Sons Co., East Liverpool, Ohio.
Thresher Electric Co., Dayton, Ohio.
Triumph Electric Co., Cincinnati, Ohio.
Union Porcelain Works, Brooklyn, N. Y.
Van Wagoner & Williams Hardware Co., Cleveland, Ohio.
Vulcanized Fibre Co., Wilmington, Del.
Warren Electric & Specialty Co., Warren, Ohio.
Warren-Medbury Co., Sandy Hill, N. Y.
Wagner Electric Mfg. Co., St. Louis, Mo.
Western Electric Co., Chicago, Ill.
Westinghouse Electric & Mfg. Co., Pittsburg, Pa.
Wirt, Charles, & Co., Philadelphia, Pa.
Zimdars & Hunt, New York.

CLASS 24.—ELECTRO-CHEMISTRY.

Abbott Electric & Mfg. Co., Cleveland, Ohio.
Acheson, E. G., Niagara Falls, N. Y.
American Hard Rubber Co., New York.
Edison Mfg. Co., New York City.
Edison, Thomas A., Jr., New York.
Electric Gas Lighting Co., Boston, Mass.
Federal Battery Co., New York.
Gordon Battery Co., New York.
Gould Storage Battery Co., Depew, N. Y.
Leclanche Battery Co., New York.
Manhattan Electrical Supply Co., New York.
New Excelsior Dry Battery Co., New York.
Non-Polarizing Dry Battery Co., New York.
Reliance Lamp Electric Co., New York.
Roche, William, New York.
U. S. Battery Co., New York.
Voltamp Electric Mfg. Co., Baltimore, Md.

CLASS 25.—ELECTRIC LIGHTING.

Adams-Bagnall Electric Co., Cleveland, Ohio.

Almond, T. R., Brooklyn, N. Y.
American Electric Meter Co., Philadelphia, Pa.
American Electric Specialty Co., New York.
American Endoscopic Co., Providence, R. I.
American Hard Rubber Co., New York.
American Miniature & Decorative Lamp Co., New York.
Anderson, H., Peekskill, N. Y.
Barron, J. S., & Co., New York.
Belden-Larwill Electric & Mfg. Co., Fort Wayne, Ind.
Bossert Electric Construction Co., Utica, N. Y.
Bristol Co., Waterbury, Conn.
Bryant Electric Co., Bridgeport, Conn.
Buckeye Electric Co., Cleveland, Ohio.
Cassidy & Son Mfg. Co., New York.
Chicago Edison Co., Chicago.
Chicago Fuse Wire & Mfg. Co., Chicago, Ill.
Colonial Electric Co., Youngstown, O.
Columbia Incandescent Lamp Co., St. Louis, Mo.
Creaghead Engineering Co., Cincinnati, Ohio.
Dale Co., New York.
Davies Incandescent Lamp Co., Syracuse, N. Y.
Devere Electric Co., Cincinnati, Ohio.
Edison, Thomas A., Orange, N. J.
Edwards & Co., New York.
Electric Gas Lighting Co., Boston, Mass.
Electric Motor & Equipment Co., Newark, N. J.
Faries Mfg. Co., Decatur, Ill.
Fisher Electric Mfg. Co., Detroit, Mich.
Frink, I. P., New York.
General Electric Co., Schenectady, N. Y.
Gilmore Electric Co., South Boston, Mass.
Goehst, Henry, Chicago.
Hardy Lamp Co., Pittsfield, Mass.
Hart & Hegeman Mfg. Co., Hartford, Conn.
Hart Mfg. Co., Hartford, Conn.
Hartwig & Miller, Detroit, Mich.
Hecla Iron Works, Brooklyn, N. Y.
Helios-Upton Co., Peabody, Mass.
Holophane Glass Co., New York.
Huebel & Manger, Brooklyn, N. Y.
Incandescent Electric Light Manipulator Co., Boston, Mass.
Inglis, William, Wire & Iron Works, Detroit, Mich.
Jewell Electrical Instrument Co., Chicago, Ill.
Kinsman, F. E., New York.
Lea Electric Mfg. Co., Elwood, Ind.
Lynn Incandescent Lamp Co., Lynn, Mass.
McLeod, Ward & Co., New York.
Malcolmson, Charles T., Chicago.
Meyrowitz, E. B., New York.
Morris Arc Lamp Co., Chester, Pa.
National Carbon Co., Cleveland, Ohio.
New York & Ohio Co., Warren, O.
Onota Mfg. Co., Pittsfield, Mass.
Orient Electrical Co., Youngstown, O.
Oxley & Enos, New York.
Pacific Electric Co., La Crosse, Wis.
Pass & Seymour, Syracuse, N. Y.
Robbins & Meyer Co., Springfield, O.
Schiff, Jordon & Co., New York.
Solar Carbon & Mfg. Co., Pittsburg, Pa.
Speer Carbon Co., St. Mary's, Pa.
Splitdorf, C. F., New York.
Stanley Instrument Co., Great Barrington, Mass.
Sterling Arc Lamp Co., New York.
Stewart, Frank H., & Co., Philadelphia, Pa.
Syracuse Electrical Instrument Co., Syracuse, N. Y.
Tiffany Glass & Decorating Co., New York.
Toerring, C. J., Co., Philadelphia, Pa.
U. S. Carbon Co., Cleveland, Ohio.
Vought, M. I., La Crosse, Wis.
Washington Carbon Co., Washington, Pa.
West, H. S., Chicago.
Western Electric Co., Chicago, Ill.
White, O. C., Co., Worcester, Mass.

CLASS 26.—TELEGRAPHY AND TELEPHONY.

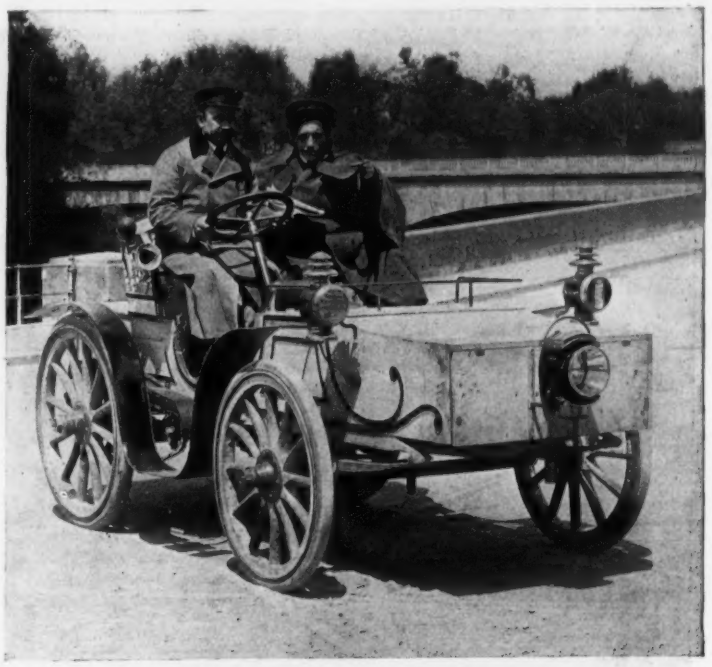
Administration des Postes des Etats Unis, Washington, D. C.
American Electric Telephone Co., Chicago, Ill.
American Hard Rubber Co., New York.
American Steel & Wire Co., Worcester, Mass.
American Wireless Telegraphy Co., Milwaukee, Wis.
Anderson, H., Peekskill, N. Y.
Ansonia Brass & Copper Co., New York.
Central Telephone & Electric Co., St. Louis, Mo.
Chicago Insulated Wire Co., Chicago.
Connecticut Telephone & Electric Co., Meriden, Conn.
Crefeld Electric Works, Providence, R. I.
Crehore, A. C., & Squier, George O., Cleveland, Ohio.
Dicke Tool Co., Downer's Grove, Ill.
Eureka Electric Co., Chicago, Ill.
Farr Telephone & Construction Supply Co., Chicago, Ill.
Fisk, H. M., Mfg. Co., Wheaton, Ill.
Foote, Pierson & Co., New York.
Gordon, A. Y., Massillon, Ohio.
Herzog Teleseme Co., New York City.
Huebel & Manger, Brooklyn, N. Y.
Illinois Insulated Wire Co., Sycamore, Ill.
India Rubber & Gutta Percha Insulating Co., Yonkers, N. Y.
Insulating Saddle Staple Co., Brockton, Mass.
International Cable Directory Co., New York.
Kokomo Telephone Electric & Mfg. Co., Kokomo, Ill.
Klein, Mathias, & Son, Chicago, Ill.
Kusel, D. A., Telephone & Electric Co., St. Louis, Mo.
McDermid Mfg. Co., Chicago, Ill.
Mianus Electric Co., Mianus, Conn.
National Automatic Telephone Co., Salina, Kan.
National Conduit & Cable Co., New York.
National India Rubber Co., Bristol, R. I.
New York Insulated Wire Co., New York.
North Electric Co., Cleveland, Ohio.
Okonite Co., New York.
Ostrander, W. R., & Co., New York.
Pacific Electric Co., La Crosse, Wis.
Partrick, Carter & Wilkins, Philadelphia, Pa.
Pennsylvania Electric Co., Marietta, Pa.
Peru Electric Mfg. Co., Peru, Ind.
Pettingell-Andrews Co., Boston, Mass.
Phillips Insulated Wire Co., Pawtucket, R. I.
Pittsburg Reduction Co., Pittsburg, Pa.
Rawson Electric Co., Elyria, Ohio.
Roebling's, John A., Sons Co., Trenton, N. J.
Rowland Telegraphic Co., Baltimore, Md.
Safety Insulated Wire & Cable Co., New York.
Simplex Electrical Co., Boston, Mass.
Sprague Electric Co., New York.
Standard Telephone & Electric Co., Madison, Wis.
Sterling Electric Co., Lafayette, Ind.
Stromberg-Carlson Telephone Mfg. Co., Chicago, Ill.
Telephone Mfg. Co., Sumter, S. C.
Varley Duplex Magnet Co., Jersey City, N. J.
Viaduct Mfg. Co., Baltimore, Md.
Waclark Wire Co., New York.
Western Electric Co., Chicago, Ill.
Western Telephone Construction Co., Chicago, Ill.
Williams-Abbott Electric Co., Cleveland, Ohio.
Williams Electric Co., Cleveland, O.

CLASS 27.—DIVERSE APPLICATIONS OF ELECTRICITY.

Abbott Electric & Mfg. Co., Cleveland, Ohio.
American Electrical Heater Co., Detroit, Mich.
American Electric Heating Corporation, Cambridgeport, Mass.
American Electric Specialty Co., New York.
*American Electrician.*
Automatic Electric Clock Co., Chicago.
Biddle, James G., Philadelphia, Pa.
Bristol Co., Waterbury, Conn.
Consolidated Car Heating Co., Albany, N. Y.
Dale Co., New York.
Eastern Electric Cable Co., Boston, Mass.
ELECTRICAL WORLD AND ENGINEER.
Eldredge Electric Mfg. Co., Springfield, Mass.
General Incandescent Arc Light Co., New York.
Gold Car Heating Co., New York.
Gordon Battery Co., New York.
Gray, Elisha, & Mundy, Arthur J., Newtonville, Mass.
Hadaway Electric Heating & Engineering Co., New York.
Iron Clad Resistance Co., Westfield, N. J.
Johns, H. W., Mfg. Co., New York.
Jewell Electrical Instrument Co., Chicago, Ill.
McCay Engineering Co., Baltimore, Md.
McGraw Publishing Co., New York.
Marshall, William, New York.
Meyrowitz, E. B., New York.
Montauk Multiphase Cable Co., New York.
Norton Electrical Instrument Co., Manchester, Conn.
Onota Mfg. Co., Pittsfield, Mass.
Queen & Co., Philadelphia, Pa.
Ritchie, E. S., & Sons, Brookline, Mass.
Sempire Clock Co., St. Louis, Mo.
Stanley Instrument Co., Great Barrington, Mass.
United Electric Heating Co., Detroit, Mich.
Wagner Electric Mfg. Co., St. Louis, Mo.
Weston Electrical Instrument Co., Newark, N. J.

## A Long-Distance French Automobile.

The accompanying illustration shows a French electric automobile which, according to *Le Velo*, recently made a journey of 156 miles at an average speed of 12 miles per hour without recharging the storage battery. The best previous record is stated to be that of a Krieger automobile, which made 90 miles on a single charge. In another case there is a record of 84 miles on a single charge, the battery weighing 920 pounds. The vehicle, which was "conducted" on the trip by M. Garcin, was made by the Société des Voitures Electriques et Accumulators, B. G. S. The carriage has a total weight of 5060 pounds, and carries two batteries of 44 cells each in two groups in parallel, and having a total weight of 2772 pounds; each



FRENCH ELECTRIC AUTOMOBILE.

cell weighs 30.8 pounds, the plates alone weighing 21 pounds. The total capacity of the battery is 320 ampere-hours. At normal speed the motor takes 22 amperes, and in ascending a grade, 36 amperes at 90 volts. This gives 108 watt-hours per ton per mile. There are five speeds ahead and two astern. The controller has also two contacts for electric braking.

## The Incandescent Lamp in Photography.

Prof. F. E. Nipher has recently made an interesting study of the development of photographic plates, the results of which seem to indicate the passing of the dark room in the near future.

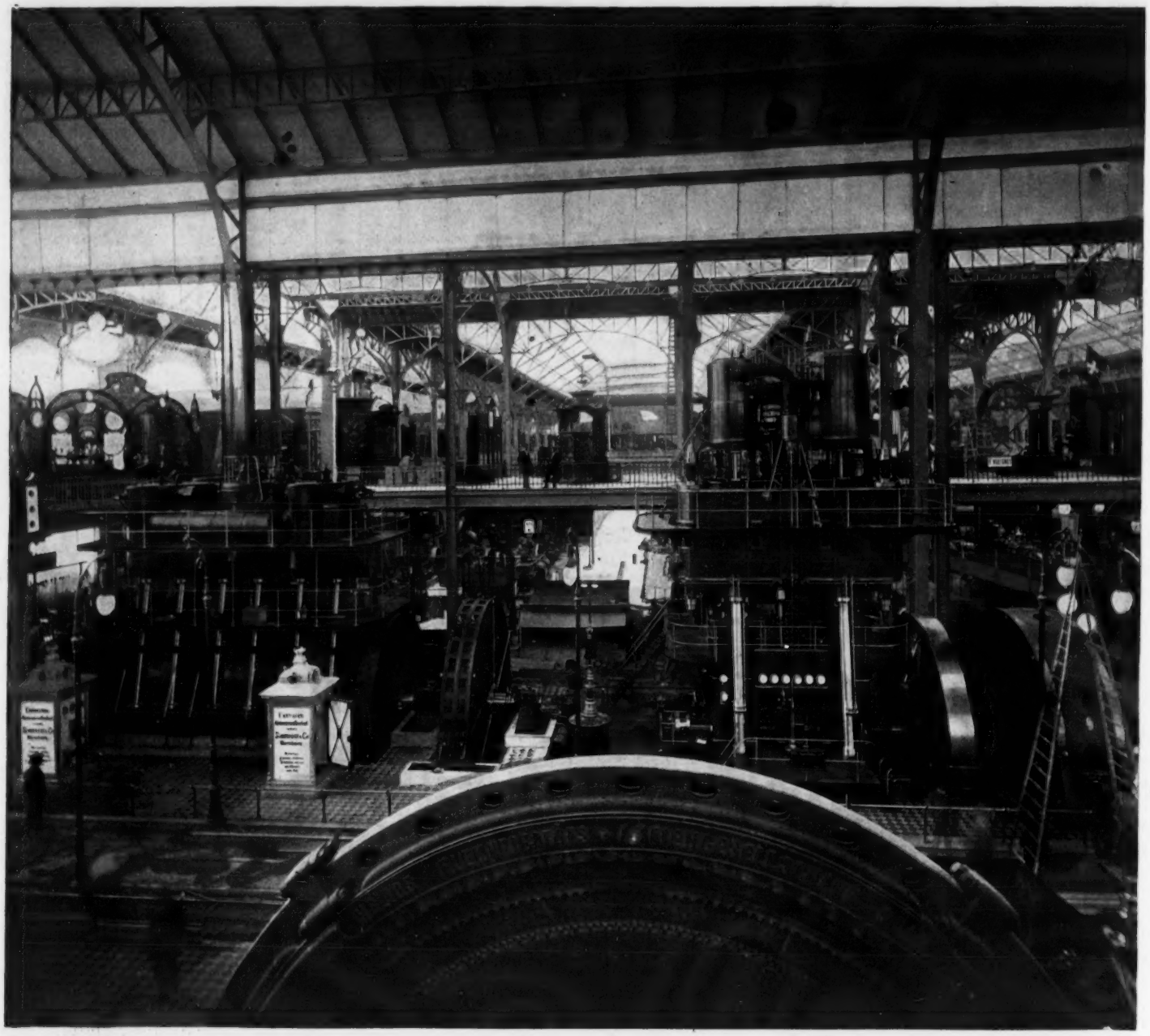
Any plate on which an impression has been made in the camera may be developed into either a positive or into a negative, the former in a light room, the latter in a dark room. The experiments of Prof. Nipher appear to show that what are usually called overexposed plates yield the best positives, and short exposures the best negatives.

A plate which will take a sunlit street scene in a second or less may be exposed for four hours if desired, or for one minute, and may be developed in the light of an incandescent lamp 5 ins. or 6 ins. to 2 ft. or 3 ft. distant with superb results. If the picture fogs, it needs more light. The same is true with Röntgen ray pictures.

A positive and a negative picture necessarily implies a zero picture, and Prof. Nipher is now endeavoring to fix the illumination of a plate in the developer, in order that a zero plate may result for various exposures. This is what the photographers call a fogged plate. They have always supposed that if too much light in a dark room gave a fogged picture in which nothing develops, that a still lighter dark room would give more fog. The experiments of Prof. Nipher, however, show that it gives less, and that the positive in the light room is just as clear and beautiful as the negative in the dark room. It follows that if a similarly satisfactory solution of the printing can be effected, so that a positive can be printed from a positive plate, the dark room will be eliminated from photography.

## Exhibit of the Electrical World and Engineer.

Up to the first day of June, when this item was written, the continued incompleteness of the ground floor, or power plant, section of Electricity Building caused a great deal of annoyance and inconvenience to visitors and exhibitors alike, and there is little possibility that matters can and exhibitors alike, and there is little possibility that matters can be in proper condition before the beginning of July. Engine and dynamo construction is still going on actively, the dust-laden air rings with the sound of the hammer, and the persistent dampness has been intensified by an unusually late spring season. Under these circumstances, several exhibitors with fine tools or machinery have kept them covered up to avoid rust and deterioration, while others with lighter exhibits t ohandle have found the gallery above a much more desirable habitation. In this latter category is the McGraw Publishing Company, which, after holding the fort in the cold and mouldy rear of the Chateau d'Eau—still in the hands of the mason and plasterer—has migrated with alacrity to the United States gallery section, in the immediate vicinity of the United States Court of Honor, and overlooking the foreign power plant and the interior of Chemistry and Transportation buildings, as shown in the accompanying engraving. All the facilities enjoyed by the friends and visitors of the ELECTRICAL WORLD AND ENGINEER are greatly improved by the change. The gallery has been filled to overflowing by a large miscellaneous gathering of American electrical and mechanical apparatus, and the space immediately adjoining that of the paper has been assigned to the American Institute of Electrical Engineers for its Paris meeting and for the period of the mechanical, electrical and transportation congresses.



VIEW FROM HEADQUARTERS OF ELECTRICAL WORLD AND ENGINEER AT THE PARIS EXPOSITION.

## Independent Telephone Association of Wisconsin.

The convention of this association was held June 6 and 7 in Madison, Wis. Eighteen companies were represented and seven others joined during the meeting. The next convention will be held at Madison in February of 1901. A resolution was passed providing that no member of the association shall sell any independent line to the Bell Company without first offering the same to the association, or to a member of the association. The executive committee recommended that a company composed of association members be formed to build long-distance copper-wire trunk lines between the larger cities of the State. Dean Johnson, of the engineering department of Wisconsin University, gave a talk on "Technical Education," and referred to the great need of manual training in public schools. Since 1871 Germany has made the most marvelous progress in the industries due solely to her fine system of practical education. Mr. J. J. Nate, manager of the Standard Telephone & Electric Company, of Madison, gave a practical and very interesting address on the telephone business in general, which was very much appreciated by the delegates. Prof. D. C. Jackson followed with a short talk on telephones, and Mr. Rall, of Chicago, talked on batteries for exchange use. The delegates were given a tally-ho ride by the Electrical Supply Company, and a steamboat ride around Lake Monona, with a full band, with a banquet at Oak Park, by the Standard Telephone & Electric Company of Madison.

## International Physical Congress Papers.

The following is a list of authors and papers on electrical subjects to be presented before the International Physical Congress to be held in Paris, Aug. 6-12:

Arrhenius—Electrolysis and ionization. D'Arsonval—High-frequency currents in relation to the human body. Bichat and Swyngedauw—Actino-electric phenomena. Blondel—Records of variable electric currents; oscillographs and rheographs. Blondlot and Gutton—Velocity of electric waves. Bouty—Gaseous dielectrics. Branly—Variation in the resistance of tubes of filings. Christiansen—Contact electricity. Du Bois—Magnetic properties of bodies. Eötvos—Study of electrical and magnetic Newtonian surfaces. Exner—Atmospheric electricity. Gouy—Standard of e. m. f. Guillaume—International decisions concerning the units and their nomenclature. Hurmuzescu—E. m. f. of magnetization. Von Lang—Electric arc. Le-Duc—Electro-chemical equivalent of silver. Lorentz—Magneto-optics. Nagaoka—Magneto-striction. Pellat—National laboratories. Poinacre—Theory of the voltaic cell. Potier—Polyphase currents. Poynting—Theory of the propagation of electricity. Righi—Hertzian waves. J. J. Thompson—Electrical discharges in gases. Villard—Cathode rays. Villari—Ionization of gas. Warburg—Magnetic hysteresis.

The above list is subject to additions. Among other papers to be presented are the following: Ames—Mechanical equivalent of heat. Barns—Pyrometry. Becquerel—Uranic rays. Gurie—New radio-active substances and Becquerel rays. Griffiths—The unit of heat. Lippmann—The absolute scale of temperature. Lummer—Emissivity of black surfaces, solid and liquid. Poincare—Relation between experimental and mathematical physics. Rubens—Large wave lengths. Witz—Recent progress in the theory of heat engines.

## Telephone, Telegraph and Cable Company.

The stockholders of the Boston & New York Telephone & Telegraph Company held their annual meeting in Dover, Del., a few days ago, at which President Chas. E. Adams presided. Directors were elected as follows: Charles E. Adams, Boston; Oakes Ames, Boston; Frank A. Cutting, Boston; W. H. Eckert, New York; H. E. Gawtry, New York; Wm. F. Hallstead, Scranton, Pa.; Z. Swift Holbrook, Boston; Wm. J. Latta, Philadelphia; Martin Maloney, New York; Jos. B. McCall, Philadelphia; Charles W. Morse, New York; Arthur S. Temple, Boston; Frank Tilford, New York; James L. Wolcott, Dover, Del. The officers of the company are: President, Charles E. Adams; secretary, John B. Stauffer; treasurer, Oakes Ames.

In his annual report, President Adams referred to the progress made in the establishing of exchanges in Boston and other Massachusetts cities and towns, and the construction of a toll line between Boston and New York. Contracts for over 5500 subscribers for five years have been secured in Boston. In the business section of Boston over 100,000 feet of underground duct have been laid up to the present time, and rights of way for the toll line between New York and Boston have been secured. The company, he said, has secured franchises and rights of way in 55 cities and towns in Massachusetts, and a model exchange is being constructed at Stoughton, Mass., which will be followed by plants in other places in the vicinity of Boston.

"The establishment of a telephone business as contemplated by the Boston & New York Telephone & Telegraph Company," President Adams said in conclusion, "requires for present construction and future growth a very large expenditure of money, but every financial emergency has been met and the business energy, together with the strong aggregation of capital that has been added to the company's resources during the past year, makes the possible future look even more satisfactory than the most enthusiastic in the early history of our company predicted."

## CURRENT NEWS AND NOTES.

*ALUMINUM TELEPHONE WIRE.*—The Sunset Telephone & Telegraph Company will use 300 miles of 7-strand aluminum wire in the new double line between Sacramento, Cal., and Reno, Nev.

*RECORD AUTOMOBILE RUN.*—A Newport, R. I., despatch states that Wm. K. Vanderbilt ran his automobile vehicle from Bristol, R. I., to Newport, a distance of 20 miles, in 30 minutes. Mr. Vanderbilt has two automobiles and his wife one.

*ELECTRIC PLANTS IN SEA-COAST FORTIFICATIONS.*—A board of engineer officers has been convened at the War Department, Washington, for the purpose of considering and reporting upon a uniform system of electric plants for the various sea-coast fortifications.

*JAPAN'S PATENT LAW.*—The recently-amended Japanese patent law fixes the life of a patent at 15 years and that of a copyright of a design at 10 years, subject to the payment of annual fees. The term of protection obtained by registration of a trade-mark is fixed at 20 years, except in the case of trade-marks previously registered abroad, where the term is the same as that for which the original registration is valid.

*USE OF TELEPHONES BY NON-SUBSCRIBERS.*—According to the new Telegraph and Telephone law of Japan, which will go into effect on Oct. 1, 1900, a subscriber who permits others than members of his family to use a telephone installed in his home for his own use, will be subject to a fine of not more than 50 yen ($25), and the outsider who uses the telephone is liable to a fine of a like amount.

*POLE TAX IN JAPAN.*—The Aldermen's Committee of Otsu, Japan, has decided on a tax of 50 sen (25 cents) per annum on every pole used in that city for carrying electric wires. As there are only about 100 poles to be so assessed, the total annual tax will amount to but 50 yen ($25), but the Electric Light Company will add this to the charge for furnishing arc lights for the front of the City Office of Otsu.

*AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION.*—The tenth annual meeting of the American Electro-Therapeutic Association will be held in New York on Sept. 25, 26 and 27, at the Academy of Medicine. The headquarters will be one block from the Academy, at the Hotel Bristol, corner of Fifth Avenue and Forty-second Street. Two important subjects on the programme for discussion are "Electricity in Gynecology" and "Electricity in Tuberculosis."

*WIRELESS TELEGRAPHY IN HAWAII.*—Mr. T. Bowden, of San Francisco, recently went to Honolulu, and is now doing the engineering work preliminary to establishing the Marconi system of wireless telegraphy, by which communication is to be maintained between the several islands of the Hawaiian group. He will locate the telegraph stations and install the apparatus. It has been decided to auction off the privilege of sending the first message over the lines. The highest bidder will be allowed to name the charity or benevolent institution to which the money will be given. An offer of $500 has been made in advance for this privilege.

*ELECTRIC TRACTION IN NEWFOUNDLAND.*—In a recent consular report an account is given of the electric railway system in St. Johns, Newfoundland, which has recently been put in operation. The length of line is seven miles, and twenty cars will be employed. The current is generated nine miles from St. Johns by means of water power, the head being 185 feet. The capacity of the plant at present is 1600 horse-power. The report states that the current is transmitted to St. Johns at a voltage of 15,000. The hydraulic machinery was furnished by the Stilwell-Bierce & Smith-Vaile Company and the electric plant and equipment by the Westinghouse Company.

*DAYLIGHT SIGNALING SYSTEM.*—In a patent issued June 5 to Lieut. Comdr. B. A. Fiske, U. S. N., a system and apparatus are described for signaling by daylight in accordance with a preconcerted code especially adapted for its use. One or more pairs of semaphore arms are employed, the arms being pivoted at right angles and adapted to be moved simultaneously from a normal position to one or more signaling positions and in such manner that at least one of the arms will be observable from all points of the horizon. The arms are installed on a mast and operated by the plunger of the solenoid, the latter in turn being actuated from a keyboard, such as that employed in the present signal in night signaling in the United States Navy.

*ELECTRIC POWER IN CANADIAN COTTON MILLS.*—The shareholders of the Dominion Cotton Mills Company, whose principal mills are situated at Hochelaga, Que., recently decided to in-

crease the capital by an additional $1,000,000 ,in order to cover cost of extensive improvements, the chief of which is in respect to the utilization of electrical energy. This great improvement consists in the installation of electric power in place of steam, and also in changing the heating system from steam coils to the Sturtevant system. Some idea of the amount of power needed to drive the immense mills of this company may be gathered from the fact that the boilers consumed a yearly average of 10,000 tons of coal. The contract recently entered into between the company and the Chambly Power Company, calls for the delivery of 3000 electric horse-power.

*INDUSTRIAL CHRONOLOGY.*—The Massachusetts Bureau of Statistics of Labor publishes annually a pamphlet entitled "Industrial Chronology," which gives the principal industrial events for the year, such as strikes, suspensions and starting-up of plants, new plants, etc. From this we learn that during the past year one new plant was erected in Massachusetts for the manufacture of electric apparatus and appliances and three additions were made to previous plants of this character; one electroplating plant resumed and three plants manufacturing electrical apparatus and appliances ran overtime and at nights. Electric light and power were introduced during the year into 19 factories. There were two strikes and lockouts in electrical manufacturing plants; two such plants changed hands during the year, and four were subjected to damage by fire.

*EDISON AND OUR PATENT SYSTEM.*—In an interview printed in a financial journal, Edison expresses an adverse opinion as to our present patent system. "An inventor," he says, "has no show these days. The moment he invents something that is an epoch-maker in the world of commerce or science there will be pirates to spring up on all sides to contest his rights to his ideas. These pirates can readily get millions at their back. They go to the courts and enjoin the inventor from using his own creation. By the faulty system of the United States courts these pirates are enabled to hold the inventor for ten, twelve or fourteen years from the use of his invention. Meanwhile, the court allows them to proceed with the use of the same device; so there is no monopoly. The inventor always gets the worst of it in the courts, even though he may hold in his hand the patent from the United States Government."

*MANUFACTURE OF CALCIC CARBIDE.*—A patent was issued June 5 to J. E. Hewes on a process for continuously producing calcic carbide. Horizontal electrodes are arranged in parallel positions below a mass of raw material, which s replenished from time to time as required and in order to keep the electrodes buried beneath it. In starting the process the horizontal-parallel electrodes are short-circuited by a block of carbon or other suitable material at the end of the furnace. The electrodes are then withdrawn from contact with this block of carbon, and the heating and reduction of material commences, after which the block is withdrawn entirely. As the process continues, the product is withdrawn from around the electrodes, and the latter are shifted either equally or together toward or away from the finished product, or evenly in the direction of the length as required by the regulation on the furnace.

*EXPOSITION IN CHARLESTON.*—It is proposed to hold an industrial exposition in Charleston, S. C., for which purpose the South Carolina Interstate and West Indian Exposition Company will be chartered in a few weeks. The people of Charleston have given the project strong financial and moral endorsement. The exposition will embrace the following departments: Agriculture, cotton, tobacco, food and its accessories, manufactures, machinery, transportation exhibits, liberal arts, engineering, public works, constructive architecture, forestry and forest products, horticulture and floriculture, phosphate rock and its products, mines, geology and minerals, fish, fisheries, live stock, graphic arts, fine arts, education, hygiene, women's department, children's department, military, negro department, United States Government exhibit, county exhibits, good roads, exhibits from Cuba, Puerto Rico and the Philippines.

*MANUFACTURE OF ELECTRICAL CONDUCTORS.*—A patent issued June 5 describes an electrical conductor stated to be adapted for use in telephone contacts, for dynamo brushes, arc-light electrodes and incandescent lamp filaments, consisting of an alloy of iron and hydrogen, the hydrogen being present in such a quantity as to prevent the action of all oxidizing agents and chlorine. The alloy, which is stated to have about one-half the weight of iron, is produced by exposing iron or steel in a converter at a temperature of 1800 degs. to an atmosphere of hydrogen generated by steam injected into the converter from a steam boiler through a coil of iron pipe constituting the hydrogen generator, and heated either in a separate furnace or in the furnace in which the alloy is made. Another method of producing the alloy is to force the hydrogen through the molten metal and then remove the alloy from the unalloyed iron either by puddling and squeezing or by grinding and sifting.

*WANDERING ELECTRIC CURRENTS.*—Prof. Aldrich recently delivered an illustrated lecture at the college of engineering of the University of Illinois on the subject of "Wandering Electric Currents." A number of interesting views were shown, illustrating how telephone and telegraph wires are frequently the cause of serious fires by crossing with an electric light and trolley wires. The effects of electrolytic action were explained and illustrated with reference to the interior wiring of buildings. One of the most difficult problems in electrical engineering, the speaker stated, is presented by the electrolytic action of structural iron work, and gas and water pipes buried in the earth, wherever they become a part of a return circuit of electric railway systems. The closing portion of the lecture referred to stray currents producing disturbances in telephone and submarine cable work.

*ELECTRIC LIGHTING CORPORATIONS IN COLORADO.*—The Colorado State District Court, in a suit between two rival electric light and power companies in Canon City, recently defined the conditions to be fulfilled before a corporation can engage in the electric lighting business in Colorado. The decision is that before a grant of power can be made permitting an electric lighting plant to be maintained in the streets and alleys of a city or town, there are necessary the approval of the grant by a majority of taxpayers by vote by, either at a regular or special election, and the formal passage by the Town Board of an ordinance in favor of the grant. The town or city also reserves the right to purchase, at intervals of ten and fifteen years after the grant, the plant of any electric light company, and this applies to companies whose right has not been perfected prior to the taking effect of the act imposing the above restrictions on a grant.

*WORCESTER POLYTECHNIC INSTITUTE.*—The current catalogue of the Worcester Polytechnic Institute contains much information of interest and value to all who are contemplating entering one of the engineering professions. The residences and occupations of all living graduates, nearly 800 in number, are shown, and it is interesting to note that they are scattered over the civilized world, engaged, almost without exception, in mechanical, civil, electrical or chemical engineering for which they were trained at the Institute. Many of them fill places of great importance and responsibility. The Worcester school was one of the earliest of its kind established in this or any other country. It has constantly added to its equipment and enlarged its facilities so as to be able to meet the more exacting requirements of the present time. As a result the demand for its graduates for some time has been much greater than the supply, and we are informed that many members of the class to be graduated in June have already received appointment to desirable positions.

*INTERNATIONAL TRAMWAYS AND LIGHT RAILWAYS EXHIBITION.*—An exhibition will be held at the Royal Agricultural Hall, Islington, London, from Saturday, June 23, to Wednesday, July 4, of this year, with the object of enabling municipal and other local authorities, tramway directors and managers, as well as the general public, to examine apparatus designed for the equipment of mechanical tramways and light railways, both surface and underground. The exhibits will consist of overhead trolley, conduit, electric surface conduit and cable systems; compressed air, gas and similar systems will also be shown. It is expected that short sections of tracks of the various systems will be laid down. A permanent way construction will be illustrated by specimens of paving, rails, joints, fishplates, road wheels, special track work, etc. Tunnel construction for underground lines will be illustrated by methods of ventilation, elevators, etc. Apparatus for power-station equipment will be shown; also rolling stock, electric car equipments, cable car equipments, steam motor cars, trucks and wheels, brakes and car fittings. The exhibition is promoted by our English contemporary, *The Tramway and Railway World.*

*SHIPBUILDING YARD POLYPHASE POWER AND LIGHTING PLANT.*—The New York Shipbuilding Company is having installed at Camden, N. J., a combination direct-current and two-phase 25-light plant to furnish light and power for its new shipyards. Prof. W. L. Robb, of Hartford, is the consulting engineer for the undertaking and the apparatus, which is being supplied by the Westinghouse Electric & Manufacturing Company, is being installed under the supervision of Mr. L. C. Richards, the electrical engineer of the yards. There will be three 500-kw generators from either of which both kinds of current may be obtained; that from the direct-current end having an e. m. f. of 220 volts, while the alternating current is stepped up to about 220 volts. The direct current is to be used for lighting and to operate the large traveling cranes, and the alternating current for running two-phase induction power motors. Each piece of machinery exceeding 3 horse-power is to have its individual equipment, lighter machinery being run from motor-driven shafting. An aggregate capacity of from 3500 to 4000 horse-power will be installed.

*ELECTRIC FURNACES.*—The Circuit Court of Appeals, sitting at Philadelphia, handed down a decision on May 28 in favor of the owners of the Cowles patents in their suit against the Corborundum Company of Niagara Falls, which decision will also probably affect other users of the electric furnace. In the opinion, the court says that it has no doubt, on the evidence presented, that corborundum can be and has been produced under the process covered by the Cowles claims, and that so long ago as 1884 the Messrs. Cowles produced it under their process with and without the use of the prepared or preformed central core of resistance material. It is true, it is stated, that the Acheson Company in practice has adopted a central core as the best method of conducting its process, and that the Messrs. Cowles have adopted a mixture without a central core as the best method, but the use of the central core of resistance material is declared to be within the process of the latter. The opinion declares that Messrs. Cowles were the first to invent and use the process in suit, and that the patent must be sustained since it is a meritorious one, and that its claims are entitled to considerable liberality of construction. As to infringement, it is decided that three claims of the Cowles process patent have been infringed, but the claim of infringement of the Cowles apparatus patent is not sustained. It will be recalled that in 1897 the litigation as to the ownership of the Bradley electric furnace patents was decided in favor of the Cowles Brothers. A suit will soon be argued in Buffalo wherein the Pittsburg Reduction Company is being sued for infringing the Bradley patents in their present process of producing aluminum by the process employed.

*SAXEN ELECTRIC RAILWAYS.*—In a consular report from Leipzig, the following table relating to Saxen electric railways is given:

| Names of lines. | Length of lines | Passengers carried | Motor Cars | Trailers |
|---|---|---|---|---|
| | *Miles.* | *Number.* | *Number.* | *Number.* |
| Dresdner Strassenbahn (including leased Lossnitz road of 8 kilometers) | 28.981 | 25,422,758 | 219 | 81 |
| Deutsche Strassenbahngesellschaft in Dresden | 18.021 | 16,351,789 | 130 | 43 |
| Grosse Leipziger Strassenbahn | 33.056 | 42,182,543 | 171 | 60 |
| Leipziger Electrische Strassenbahn | 32.881 | 17,763,102 | 110 | 50 |
| Allgem-Local & Strassenbahngesellschaft Chemnitz | 14.727 | 8,574,966 | 60 | 47 |
| Zwickauer Strassenbahn-Actiengesellschaft | 3.704 | 1,785,887 | 16 | 2 |
| Sachsische Strassenbahngesellschaft Plauen | 3.022 | 1,334,766 | 15 | ..... |
| Schandauer Electrische Strassenbahn | 5.158 | 124,611 | 6 | 6 |
| Meissner Strassenbahn | 2.893 | 51,958 | 4 | ..... |
| Total in 1899 | 142.441 | 113,592,390 | 731 | 289 |
| Total in 1898 | 110.272 | 90,576,266 | 591 | 238 |

It is stated that many new improvements have been introduced upon the roads of Saxony during the past year. Among them are the triple brake on the cars of the Weissen Hirsch line, as an extra precaution on heavy grades; the heating of the cars by electricity on the Weissen Hirsch and the Lössnitz lines, and the introduction of a device for preventing the strong acid smell in the accumulator cars. The magnetic brake which operates simultaneously on any number of cars, which was first introduced in Dresden at the instigation of the commissioner of electric roads, has been generally adopted throughout Saxony and introduced upon some of the roads of the neighboring States.

# LETTERS TO THE EDITORS.

## Cylinder Lubrication.

*To the Editors of Electrical World and Engineer:*

Sirs:—In your issue of June 2, is an editorial discussing the paper which I read at the recent convention of the N. E. L. A., and which editorial takes exceptions to the views I expressed relating to the use of compounded cylinder oil.

The editorial says: "In the case of surface condensation the use of such compounded oils cannot be too strongly condemned," for the reasons, as it appears later in the article that, first, compounding is unnecessary, and that, secondly, such oil when mixed with the feed-water is very injurious when returned to the boiler.

On the second point there can be no argument, but in the plant referred to, the oil is kept out of the boilers by passing the feed-water downward through a bed of sand, which removes almost every trace of oil from the water. In fact, the repairs upon the 5000 horse-power of boilers of this particular plant have not amounted to one hundred dollars in five years.

As to the merits of compounded oil, to quote from the paper referred to, "The results of our experiments have convinced us that the only oil to use in a non-jacketed cylinder where it would come in contact with very wet steam, is one which is very highly compounded."

Indeed, when any other oil was used, the high-pressure cylinder did not acquire an oily gloss, but the cylinder walls were dry and wore so much that it became necessary in a short time to rebore the cylinder.

We have obtained excellent results from a pure mineral oil on a pump where the steam was dried and superheated by being drawn through the throttle valve, but wet steam always requires compounded oil to make it adhere to the cylinder walls.

CHICAGO, ILL. W. L. ABBOTT.

[The final statement involves a contradiction of the results obtained in the marine practice of the world.—EDS.]

## Transformer Magnetic Leakage.

*To the Editors of Electrical World and Engineer:*

Sirs:—Referring to the letter of Mr. Joseph Bijur in your issue of June 9, I would state that my comments on Mr. Bijur's letter of May 19 were directed more particularly to his conception of the term "magnetic leakage," and that it was not my purpose to enter a discussion of the theories of transformer action; two different definitions of the term "magnetic leakage" would naturally lead to different explanations of the various transformer phenomena. Apparently, Mr. Bijur defines "magnetic leakage" as those lines of force, which at no load, pass through the primary coil and not through the secondary coil; that is to say, it is the stray portion of the field due to the magnetizing current; this quantity he considers, and probably rightly, to be constant. My own conception of this term includes the field set up by the total or resultant current, in either coil, which does not pass through the other coil, and of course such fields vary with the load.

As to the question of either coil being considered as encircled by two fields, the main core flux and the leakage flux, it seems hardly necessary to point out the customary method, in dealing with vector quantities, of breaking up a resultant quantity into its two components for more convenient analysis. In this case, the main core flux is in phase with the magnetizing component of the primary current, and the leakage flux in phase with the resultant current in the particular coil considered. In the secondary, the difference in phase in these two quantities may be anything from 90 degs. to 180 degs., according to the lag in the secondary circuit; thus it is not permissible to deduct in the secondary coil the leakage field from the main core flux, and call the remainder the effective secondary flux.

As to the question of the secondary drop being due to the primary resistance, this is always taken account of by estimating the percentage drop at non-inductive load as the sum of the ohmic drops in the two coils; these ohmic drops are never quite in phase with the

induced e. m. f., and in taking their sum, the influence of Mr. Bijur's stray field is more than provided for.

JOHNS HOPKINS UNIVERSITY. JOHN B. WHITEHEAD, JR.

## Telephone Service and Passenger Transportation.

*To the Editors of Electrical World and Engineer:*

Sirs:—The *Railroad Gazette* of May 11, 1900, publishes data taken from the Interstate Commerce reports, which show that for the year ending June, 1889, the freight traffic of this country amounted to 68,727,000,000 ton-miles. The report for 1899 shows this traffic to have amounted to 114,078,000,000 ton-miles, an increase of 66 per cent, as against 21 per cent increase in population. In 1898, the passenger traffic was 11,554,000,000 passenger-miles. In 1899, 17,380,000,000 passenger-miles, or an increase of 16 per cent with the same increase in population.

While this showing is something extraordinary, it will be noted that the percentage of passenger-miles per capita is less in 1899 than 1898. Considerable surprise is expressed at this difference in the growth of the two kinds of railway traffic. An attempt has been made to account for some of this difference by ascribing it to the increased mileage of street railway passenger traffic, but the grounds hardly seem tenable.

To my minds it seems quite possible that a large proportion of this difference is due, not to "electric road" competition, but to the "long-distance telephone" service. The impression among many steam railroad men is that the trolley car is about to become a very serious competing factor, overlooking the advertisement of the telephone company, which simply says, "Don't travel, telephone."

The monetary value of time has increased since Franklin's day. It is quite impossible to send merchandise by telephone, it is therefore quite possible for "trunk line" organizations or "gentlemen's agreements" (pool agreements) to fix and maintain freight rates, but it does not follow that they can maintain passenger rates at the same figure or, in some instances, raise them above the rates of 1880. "Behold, how great a matter a small fire kindleth."

NEW YORK. FRANK E. KINSMAN.

# DIGEST
OF
# CURRENT ELECTRICAL LITERATURE.

Temporarily Conducted by E. F. ROEBER, Ph. D.

### DYNAMOS, MOTORS AND TRANSFORMERS.

*Induction Motors.*—EBORALL.—A very brief abstract of a paper read before the British Inst. of Elec. Eng., in which it is stated that the first part dealt with induction motors in general, simple and polyphase, the second with single-phase starting devices, leading up to the "glorification of the Heyland motor." Some concluding remarks expressed a belief that single-phase is "played out." The paper is said to consist throughout of details of construction and technical reasons for them, and to be too technical for any summary without diagrams.—*Lightning,* May 24.

In the discussion which followed, Field gave an explanation of the starting of the Heyland motor. Rhodes said that too much attention had been devoted to the stator windings, and for further improvements one would have to look to the rotor; the Heyland motor was, as far as the rotor was concerned, worked on the resistance idea of cutting down starting current; but putting in resistance into rotor coils only diminishes the demagnetizing field, that is, cuts down the whole current, and the energy component of current is also affected; what is wanted, if possible, is to wipe out the self-induction of the rotor coils; it is impossible to do this by inserting non-inductive resistance; he had attempted the experiment of introducing into the rotor circuit a counter e. m. f. Carus-Wilson referred to the results obtained by Steinmetz, "the Clerk-Maxwell of the alternating-current motor," by the use of a condenser with an induction motor (A. I. E. E. paper, Jan. 24, 1900). Ferranti thought that single-phase systems are just commencing their usefulness; they would be found cheapest, most efficient, and generally most satisfactory; whatever improvements are made in polyphase working, they will never be so good generally as low periodicity single-phase systems.—*Lightning,* May 24; *Lond. Elec. Rev.,* May 25.

An editorial on Eborall's paper. His statement that the self-induction of the starting coil is less than that of the running coil, is shown to be very misleading. It is agreed to be true that by the use of condensers it is possible to bring the power factors of induction motors to unity, "but it is hardly practicable; for a motor taking 100 amperes, and having a power factor of 0.8, the wattless current would be 60 amperes, and to neutralize this by means of condensers would require a capacity of something like 600 microfarads at 100 volts and 100 periods; now, 600 microfarads is, to say the least, rather unwieldy, and would cost more than many motors to build. As motors are built at present, the only way to obtain a high power factor on load is to make a really good mechanical job, making the stator and rotor cores absolutely concentric and having only just enough air-gap for mechanical clearance; it follows that the bearings must be of the very best." The writer agrees with Ferranti, that the single-phase system will at least hold its own. "The starting torque of single-phase motors is almost as good as that of polyphase motors, and for transmission purposes the single-phase system is certainly the simplest. If single-phase motors are shown to be equal in all respects to polyphase motors, polyphase systems must give way."—Lond. *Elec. Rev.,* May 25.

REFERENCE.

*Induction Regulators.*—An illustrated description of induction potential regulators of the General Electric Co.—*Jour. of Elec.,* May.

### LIGHTS AND LIGHTING.

*Regulator for Arc Lamps.*—BERTHIER.—An illustrated article suggesting that the distance between the two carbons be kept constant, by fixing the lower carbon on a holder floating on a liquid or on mercury, and by choosing the arrangement so that when the carbon burns off and, therefore, the weight of the carbon and its holder decreases, they raise just so much that the distance between the two carbons remains constant. In order to allow the contact of the carbons in the moment of lighting, he suggests the use of an auxiliary floating iron core, surrounded by a solenoid; as long as there is no current, the core flows on the mercury and the two carbons are in contact; when the current is switched on, the solenoid attracts the core, the level of the mercury falls and the carbons are separated from each other. He makes some other suggestions and gives estimates of the cost of arc lighting with his device, but does not say whether he has tried his arrangement experimentally—*Cosmos,* May 26.

*Heat of an Incandescent Lamp.*—A note, stating that a "small incandescent lamp" placed in a vessel containing half a liter of water heats it up to the boiling point within less than an hour; when placed in contact with celluloid, it ignites the same in five minutes; it is very dangerous to place incandescent lamps in the proximity of cotton wool; silk is less inflammable, but is scorched at a distance of 3.9 in from eight to ten hours.—Lond. *Elec. Eng.,* May 25.

### POWER.

*Power Consumption of Machine Tools.*—LOCH.—An account of measurements made in a railway shop at Gleiwitz, Germany, to determine the proper size of motors to run the various machines. There are 107 motors with a combined output of 334.5 horse-power. He gives a list of 57 tools, with their corresponding motors. Among other results, it was found that a planer with a working surface 118 ins. x 39 ins. needed a 5-hp motor, while another, 63 ins. x 34 ins., took 3 horse-power; a shaping machine, with a 12-in. to 16-in. stroke, used 2 horse-power, the same as a circular saw 20 ins. in diameter, while small and medium lathes require 1 to 2 horse-power. The motor has to carry not only the ordinary load, but must be able to bear the extra load at the starting of the machine, the current used at starting being from one and a half to three times that required under normal conditions; the reversal of the motion or the quick back-stroke of the working parts often demands the greatest energy; in the wood-planing machines, for instance, requiring more than the working stroke. The influence of different speeds on the power

consumption is shown by the example of a shaping machine.—*Glaser's Ann.*; abstracted in *Eng. Mag.*, June.

*Power Distribution in Northern Italy.*—An editorial note referring to a remark of S. P. Thompson in the discussion of Forbes' recent paper on a water-power station, in course of erection at Vizzola, near Lake Maggiore, for providing power for the industries in a large number of flourishing manufacturing towns in that part of Lombardy, which use at present some 10,000 horse-power of steam power. The effective electric power will be about 12,000 horse power. Seven turbines have been erected, each coupled to a 1650-kw three-phase alternator, running at a pressure of 11,000 volts, and there are two exciters, driven by separate turbines, with a capacity of 145 kilowatts at 110 volts. The average price at which the electrical power is to be supplied is $21 per kilowatt per year for 12 hours' use per day, the price for 24 hours' use per day being only slightly greater. (Compare the price in Norway, as noticed in the abstract on calcium carbide, under Electro-Chemistry.)—Lond. *Elec.*, May 25.

*Long-Distance Transmission.*—A description of the power transmission from Mescla to Nice, in France, the distance being 19 miles. The water-power station in Mescla contains three turbines, coupled to three 500-kw alternators, generating three-phase current at 10,000 volts, the frequency being 25. The current is transmitted by six overhead copper wires to the main sub-station of Ste. Agatha, where one part is converted to 550 volts direct current, partly by motor-generators and partly by transformers and synchronous converters, for supplying power to the tramway system of Nice; the balance is transmitted to other converter sub-stations.—*La Nature*, May 19; more briefly in *St. R'y Jour.*, June.

*Power Transmission.*—GURNEY.—An illustrated description of the power transmission to the Utica Mine at Angel's Camp, Calif. The water-power plant is at a distance of about eight miles from the mines; when completed, it will have three 750-kw, 500-volt, two-phase alternators. The current is transformed to 16,500 volts, three-phase, and transmitted over a copper line to Angel's Camp, and from there by several special three-phase lines to other mines, for operation of induction motors and for arc and incandescent lighting.—*Jour. of Elec.*, May.

*Electricity for Agricultural Purposes.*—RENAUD.—Continuation of his article, the first parts of which were noticed in the Digest June 2. He gives illustrated descriptions of some more types of plows, operated electrically, and gives in a table the efficiency of the different described systems. He then discusses briefly electric traction for agricultural purposes, and sums up the advantages of using electric power for agriculture, as follows: An available water power or an existing steam plant, which is otherwise used only for short periods of the year, as in distilleries, sugar plants and starch works, may be utilized to give the power for plows, centrifugal pumps, circular saws, etc. An electric motor may be used to drive different machines, as it may be easily transported from one to another; the flexibility of the electric power transmission and distribution systems is very valuable for agricultural purposes; the electric power may be used also for lighting, which diminishes the dangers of fire, etc. The article is fully illustrated with pictures of a great many agricultural apparatus operated electrically.—*L'Elec.*, May 19, 26.

REFERENCES.

*Electric Power in Factories.*—ALDRICH.—The first part of an illustrated reprint in full of the paper, an abstract of which was noticed in the Digest June 9.—*Power*, June.

*Polyphase Transmission for Electric Railways.*—A list of some 30 electric railway companies in the United States using polyphase power transmission, with the amounts of power transmitted in horse-power. In every case the current is converted in sub-stations to continuous current for use on the trolley line.—*St. R'y Jour.*, June.

*High Voltage Line Insulator.*—An illustration, with brief description, of an insulator to be used on a 200-mile 60,000-volt transmission line. It is of brown china with a glass centre. Each insulator is 10½ ins. in diameter, and weighs about 12 lbs. It is mounted on a wooden pin.—*St. R'y Jour.*, June.

TRACTION.

*Competition of Electric Automobiles.*—A preliminary account of the competition of electric automobiles, held in the last week of April in Berlin, under the auspices of the Motorcar Society of Central Europe, under the direction of Dr. Kallmann. Thirteen automobiles, all of German make, entered the competition, of which seven were for freight and six for passenger service, the weight of the latter, without passengers, being between 2068 and 3850 lbs.; that of the former, unloaded, between 3498 and 9064 lbs. On the first day of the tests, 15 miles were covered with moderate speed, and at short intervals measurements of the energy consumed were made; the most favorable result was 96.6 watt-hours per ton of rolling weight and per mile. On the other days of the tests, further trials were made with different speeds and under different conditions, especially for testing the ability of steering and braking; these tests were in general very satisfactory. The best braking result was obtained with an automobile for freight service, which was running at a speed of 8 miles per hour, and, when braked, pulled up in 14 feet; other automobiles, running at speeds of 11 and 12.4 miles per hour, pulled up, in the mean, in 29.5 feet. In a test for the highest obtainable speed, an automobile for passenger service, running at a speed of 12 miles per hour on a macadamized road, showed an energy consumption of 140 watt-hours per ton mile. Although the automobiles were subjected sometimes to very severe strains, no breakdown occurred during the tests, and there was only a very small number of little accidents, the repair being made at once by the driver. In general, the writer of the article is under the impression that, provided a sufficient life of the batteries—which was, however, not tested in the trials—the electric automobile is already a vehicle useful in practice.—*Elek. Zeit.*, May 10.

*London.*—A well-illustrated article on electric traction on the Metropolitan District Railway, where quite recently an electric train was first put into operation on the regular time bill, on the so-called experimental line, which is about 5000 ft. in length, and has on some places very severe gradients. The reason of the operation of this experimental line was that "the boards of the associated railway companies needed tangible proof that their railway system could be converted from steam to electric traction without the least interference, during the process of their odinary railway service." This has been accomplished. The system is a four-rail system; it includes the two ordinary track rails, which are not used for any electrical purpose whatever, and two electric rail conductors placed on either side outside the track, and consisting of inverted channel steel, weighing 75 lbs. per yard, and carried on double petticoat porcelain insulators mounted on steel bolts. The train consists of two motor cars, placed at either end, and four intermediate cars; each motor car has four series motors, each developing a normal drawbar pull of 4000 lbs. and a normal power of 110 horse-power, the maximum power being 200 horse-power; only the front motor car is used at a time for driving. Current is collected from the positive working conductors and returned to the negative working conductors by means of flexible cast-iron shoes suspended from the bogeys; there are 14 shoes on the train, seven on each side. It is intended to carry out a series of careful experiments on electric traction by means of this train. An outline of the history of this experimental line is given in a separate editorial.—Lond. *Elec.*, May 25; other descriptions in Lond. *Elec. Eng.* and *Elec. Rev.*, May 25.

*Boston and Lexington Railway.*—A long, well illustrated description of this interurban railway, which has a length of about 20 miles, and connects with another road by which passengers are carried between Boston and Lowell. The time required for this trip is two and a half hours, and the fare is 30 cents. Each car is equipped with four 35-hp motors. The construction of the cars and of the car house is described. The power station contains two 325-kw generators, and an 850-kw generator will be installed for the next increase.—*St. R'y Jour.*, June.

*Geneva.*—An illustrated article, stating that an American syndicate is about to introduce electric traction on the tramways of Geneva, Switzerland. The whole length of line will be 97 miles. The power is to be furnished by the municipal water-power station at the rate of 2.4 cents for the first 1,800,000 kilowatt-hours used; after this amount, the city will either furnish the power at 1.8 cents per kilowatt-hour, or else concede the company the right to generate its own power.—*Elec. Rev.*, May 30.

*Moscow.*—A short, illustrated description of the 5.7 miles electric line, noticed in the Digest Mar. 10. Three-phase current is obtained from a neighboring lighting station and is converted to 500 volts direct current. During four weeks of last August some tests were made to determine the current consumption, which was found to be 685 watt-hours per motorcar mile direct current.—*St. R'y Jour.*, Int. Ed., June.

*Belgium.*—An abstract of the annual report of the National Society of Light Railways of Belgium for the year ending December, 1899.

The company has in operation 1072 miles, in actual construction 314 miles, ready for construction 64 miles of light railways and tramways, most being operated by steam. Four are operated by electricity, or in course of erection. Of these, one of seven miles has been in operation since 1896, and the traffic is constantly increasing. Electric equipment of another line has been delayed, as the company preferred to use the centre trolley wire, while the government is insisting on the use of the lateral trolley wire.—*St. R'y Jour.*, June.

*Track Construction.*—A fully illustrated article on the track construction used by an electric railway company in New Orleans, which has recently laid about 15 miles of track with T-rail. Each rail is 60 ft. long, weighs 100 lbs. per yard and is 5¾ ins. high, makprobably the heaviest T-rail track ever laid for electric service.—*St. R'y Jour.*, June.

*United States and Canada.*—A large table showing the miles, the cars and the capital liabilities of operating street railways in the United States and Canada for the two years 1898 and 1899. The total number of miles in the United States has increased 9.5 per cent from 1898 to 1899; all of this increase and more occurred in electric roads, as the mileage of the cable, horse and miscellaneous railways decreased. The mileage of electric railways at the end of 1899 was 17,969 in the United States and 720 in Canada, against 15,942 and 634 in 1898.—*St. R'y Jour.*, June.

REFERENCES.

*Distributing Systems for Electric Traction.*—SAYERS.—A communication in which he replies to Tomlinson's article (Digest, June 9). He denies that he started out by studying a particular system and then drew from the results certain general deductions as an afterthought. His paper commenced by pointing out the general conditions to be fulfilled by the distributing system, and then discussed the general laws of economical distribution so conditioned, and showed how they affect the choice of system generating the power.—Lond. *Elec. Rev.*, May 25. Continuations of an illustrated reprint of Sayers' paper in Lond. *Elec. Rev.* and *Elec. Eng.*, May 25; the first part of the paper in Lond. *Elec.*, May 25.

*Three-Phase Railway.*—A short note on the first electric railway in Germany, using three-phase motors. It is being built near Oberammergau in Bavaria. It is 24-km. long, and current will be generated by water power.—*St. R'y Jour.*, Int. Ed., June.

*Predetermination of Storage Batteries for Tramway Power Houses.*—BRANDT.—A French translation in abstract of the German article, noticed in the Digest Nov. 11.—*L'Ind. Elec.*, May 25.

*Controller Diagrams.*—An article, accompanied by several diagrams, of General Electric controllers and car wiring, the first showing the ordinary rheostatic controller used with one motor, the second the type K 2 controller used in series-parallel connections with shunted fields, the third and fourth showing the series-parallel controllers for two and four motors, respectively, without shunted fields, and with metallic circuit connections.—*St. R'y Jour.*, June.

*Power Records of Electric Cars.*—An account, illustrated by diagrams, of some tests made on the Potteries Electric Tramways of England, as to the power required by electric cars on different grades. —*St. R'y Jour.*, June.

*Testing Rail Bonding.*—WALMSLEY.—A communication suggesting an improvement in Herrick's method (Digest, May 12).—*St. R'y Jour.*, June.

*Surface-Contact System.*—PERKINS.—An illustrated description of the surface-contact system, used on a line in the naval proving grounds of the U. S. Government at Indian Head, Md.—*El'ty*, June 6.

*Alexandria.*—POLLATCHEK.—An article on the tramways of Alexandria, Egypt. The trolley system is used, the voltage being 550.—*L'Elec.*, May 26.

*Graz.*—POSCHENRIEDER.—An abstract of a paper, read before the Electrotechnical Society of Vienna, describing the changing over of the tramway system of Graz, Austria, to electric service.—*Elek. Zeit.*, May 10.

*Germany.*—Some notes from Germany, stating that an accumulator car has been put into service on a railroad line in Wuerttemberg, for replacing the steam service for local business. Berlin, with two-fifths the population of London, has twice as many street cars; Paris, with a population half that of London, has about as many cars as London, while Vienna, has about one-third as many as Berlin.—*St. R'y Jour.*, Int. Ed., June.

*Automobiles.*—RUSH and JOY.—An abstract of a paper, read before the Brit. Inst. of Junior Engineers, in which they gave a short review of the motor car industry, past and present. As motive power "electricity, except for very limited purposes, was regarded as impracticable at the present time."—Lond. *Elec. Rev.*, May 25.

INSTALLATIONS. SYSTEMS AND APPLIANCES.

*Office Buildings.*—BOLTON.—An article on the electrical equipment of tall office buildings. He claims that the experience of the past few years with electric elevator service has shown that, without the addition of a storage battery, the high-speed electric elevator is not so economical as the hydraulic; the additional cost of a storage battery, with interest and depreciation thereon, outweighs any economic gain obtainable; without a battery, the service cannot be combined satisfactorily with lighting work; a higher class and greater extent of labor is necessary with electrical elevator machines; the cost of maintenance and repairs is largely in excess of the same items with hydraulic machines; the cost of outside electrical supply is too great to admit of economical consideration in this class of building. He then discusses the electric lighting of the building, and advocates a "vertical" arrangement of wiring, the circuits being run up the line of outlets arranged so that they take corresponding positions on the respective floors, and connecting to distribution centres in the cellar. The requirements of the lighting load are best met by a division of the generating units into three, preferably of unequal sizes; he discusses, briefly, in which cases a storage battery may be desirable. He claims emphatically that the generation of electric power by an internal plant can be made more cheaply than by outside supply companies, and says that until current can be supplied by an outside company to such buildings during the hour of maximum load at less than two cents per kilowatt-hour, it will not enter into competition with the internally generated supply; he gives some estimates of cost of installation and operation of a plant, to prove his assertions.—*Eng. Mag.*, June.

*Insulated Plants vs. Public Supply.*—A brief editorial note and a longer separate article, criticizing a recent article of the Lond. *Eng.*, in which it was sought to show that the total cost of production of light from a private generating plant, including fuel, interest and depreciation, maintenance and repairs, is less than the cost of obtaining current from the public supply companies' mains, even when the number of lamps installed is as small as fifty 60-watt lamps, the chief fallacy in the argument being that an impossible number of burning hours was assumed as a basis of calculation. A private installation cannot commence to be remunerative until the saving in the cost of production, as compared with the price charged by the supply companies, is equivalent to all the costs incurred by the establishment of private generating plant, except those common to both systems. In large hotels and other institutions where power is used for a variety of purposes, the additional steam power and attendance required for the generation of electric energy for lighting is very simple; but when it becomes a question of putting down motive power and generating plant solely for the purpose of electric lighting, the size of the installation which would warrant such a course, is very largely governed by the expediency or necessity of having electric light, and the degree of difficulty or the inadvisability of obtaining it by any other means.—Lond. *Elec. Rev.*, May 25.

REFERENCE.

*Charging Batteries from Alternating-Current Mains.*—An illustrated description of a Westinghouse outfit for charging batteries from two-phase alternating-current mains. It consists of a synchronous converter, two auto-transformers, one in each phase, and the switchboard.—*Jour. of Elec.*, May.

WIRES, WIRING AND CONDUITS.

REFERENCES.

*Protection of Insulated Wires.*—BATHURST.—An article referring to and criticizing some points in the article of Walker, abstracted in the Digest May 26 and June 2. He says that the general experience gained with insulating lined tubes, using a fibrous bituminized material as their basis, has given full and complete satisfaction in every condition of installation.—Lond. *Elec. Rev.*, May 25.

*House Wiring.*—An editorial in favor of S. P. Thompson's suggestion to use an uninsulated or a semi-insulated return conductor for interior wiring (Digest, Dec. 16).—*Jour. of Elec.*, May.

*Cable Breakdowns.*—KAPP.—A French translation of the German paper, abstracted in the Digest Jan. 20.—*L'Ind. Elec.*, May 25.

ELECTRO-PHYSICS AND MAGNETISM.

*Resistance of Thin Metallic Films.*—LANGDEN.—A brief paper on

the electrical resistance of thin films deposited by cathode discharges. Their resistance is very much higher, as compared with thicker films of the same kind, than their thickness would seem to indicate. In many cases temperature changes do not produce such variations of resistance as are common in ordinary wire resistance. All very thin films have negative temperature coefficients, and films within a certain range of thickness have zero or negligible temperature coefficients; a peculiar relation was found between the magnitude of the temperature coefficient and the process of artificial ageing. Such resistances when properly prepared, may be regarded as standards of a very high degree of accuracy; they may have any desired value, from a few ohms up to several megohms.—*Am. Jour. of Sc.*, June.

*Tellurium.*—LEHNER and MORGAN.—An account of measurements of the specific resistance of tellurium. The values found varied between 279 and 1152, the mean was about 500. Matthiessen's value is about 2000. It appears that the structure has an enormous influence on the conductivity.—*Jour. Am. Chem. Soc.*; abstracted in Lond. *Elec. Eng.*, May 25.

*Roentgen Rays.*—TROWBRIDGE.—A brief paper describing experiments in which he produced Roentgen rays in an efficient manner by means of a storage battery of 20,000 cells in series with a distilled water resistance of about 4,000,000 ohms. The great advantage of this new method of generating the rays is in the possibility of regulating the current and the difference of potential which is necessary to excite the rays. The phenomenon of the occlusion of gases seems to be the controlling one in the production of the rays and not the degree of exhaustion.—*Am. Jour. of Sc.*, June.

*Electricity and Magnetism.*—W. A. P.—An article referring to the theoretical paper of Fessenden, abstracted in the Digest Feb. 10 and Apr. 7. He says that the argument by which Fessenden discriminates between two possible systems of units and the two corresponding theories of ether, is neither very clear nor very satisfactory. While the mode of argument appears unsound, it seems that if it could be defended, it would defeat its own object. But "his experiments on the relations of $H$ and $u$, the great quantity of information given under the head of corroborative evidence, and the ingenious proposal for rationalizing the electrical equations make the paper one of exceptional value and interest."—Lond. *Elec. Rev.*, May 25.

*Electromagnetic Experiment.*—S. P. THOMPSON.—An abstract of a British Physical Society paper, in which he describes the following experiment, which was briefly noticed in the Digest June 2. A circular coil capable of carrying a strong current, was placed with its axis horizontal in a tank of water, into which were also placed some small magnets in sealed glass tubes so adjusted as to have a density approximately equal to that of water, so that they just floated or just sank. On running a current through the coil, it was possible to "fish" for the magnets, which, acted upon by the magnetic field, immediately made their way to the coil. When the current was carefully reversed, upon the approach of a magnet repulsion took place instead of attraction, and the magnet retreated. In general, however, reversal of the current produced reversed polarity in the magnet, and attraction still persisted.—Lond. *Elec.*, May 25.

*Peltier Effect.*—POCHETTINO.—An account of an experimental investigation of the variations of the Peltier effect in a magnetic field. When the field increases, the coefficient of the Peltier effect first increases to a maximum and then decreases down to its normal value; the variation of the Peltier effect is independent of the direction of the field.—*Il Nuovo Cimento*, October; abstracted in *L'Eclairage Elec.*, May 19.

*The Hall Effect and the Resistance of Bismuth at Low Temperatures.*—EVERDINGEN.—An account of experiments made at —70 degs. C. With decreasing temperature the Hall effect increases, especially in weak fields. The variation of the resistance of bismuth in a magnetic field depends upon the angle between the lines of force and the crystallographic axes of the metal.—*Acad. Roy. d'Amsterdam*, Nov. 25; abstracted in *L'Eclairage Elec.*, May 19.

REFERENCES.

*Thermo-Electricity.*—SPADAVECCHIA.—An account of an experimental investigation of the influence of the magnetism upon the thermo-electric properties of bismuth and of bismuth-tin alloys, in continuation of the work of Grimaldi.—*Il Nuovo Cimento*, June, 1899; abstracted in *L'Eclairage Elec.*, May 19.

*Wave Form of Three-Phase Currents.*—BENISCHKE.—A reply to a critical remark in Bragstad's paper (Digest, Apr. 28) on a point in Benischke's paper (Digest, Jan. 13).—*Elek. Zeit.*, May 10.

*Cathode Rays and Roentgen Rays.*—VILLARD.—A long, illustrated paper, read before the International Society of Electricians in Paris, giving a full outline of the work done in this line up to the present time.—*Bull. de la Soc. Int. des Elec.*, April.

*Roentgen Rays.*—ROLLINS.—A continuation of his long serial, giving a note on the use of nitrogen in a Roentgen ray tube, and another on the relation between the "resistance" of a Roentgen ray tube and the occlusion of gases in the metal terminals.—*Elec. Rev.*, May 30.

*Rarefied Gases.*—SCHMIDT.—A long paper on the influence of temperature on the potential-fall in rarefied gases.—*Ann. der Physik.*, No. 4; abstracted in *Am. Jour. of Sc.*, June.

*Magnetic Viscosity.*—LIZZIE LAIRD.—A French abstract, with a diagram, of the German paper noticed in the Digest Mar. 24.—*L'Eclairage Elec.*, May 19.

*Thermo-Magnetic Effect in Bismuth.*—YAMAGUCHI.—A French abstract, with diagrams, of the German paper noticed in the Digest Mar. 10.—*L'Eclairage Elec.*, May 19.

ELECTRO-CHEMISTRY AND BATTERIES.

*Accumulators for Automobiles.*—SIEG.—An article on the construction of accumulator batteries for automobile service. He discusses first what is required of such a battery. He supposes that the weight of the load, consisting of four passengers, battery and motors, is two-thirds of the total weight, which has to be not over two tons in order to allow good steering; further, that the automobile has to run at least three hours continually for one charge, with an average speed of 11 miles per hour on a fair, level road; he finds that in order to fulfil these requirements, the battery must have a capacity of about 4 ampere hours per pound of total weight of cell, when discharged in 5 to 6 hours. As for stationary storage batteries the capacity is between 1.5 and 2.5 ampere hours per pound, the automobile battery must have about half the weight for the same capacity. The decrease in weight can be obtained in three ways: first, by diminishing the weight of the boxes by use of ebonite boxes; second, by diminishing the weight of the acid by decreasing the distance between the plates; as an ampere hour always consumes a certain quantity of pure sulphuric acid, an increase of concentration is required for this purpose; to prevent the danger of short circuits, he says intermediate corrugated perforated ebonite plates have proved to be the best, although expensive. The saving of weight in boxes and acid is, however, not sufficient to yield the necessary decrease of weight to the half that of stationary cells of the same capacity, because the weights of the electrodes in the latter is about 50 to 60 per cent of the whole weight. Therefore the weight of the electrodes also must be diminished; this necessarily involves a decrease of the life and durability of the plates. He believes grid plates to be the only suitable plates for automobile batteries. The well-known German accumulator manufacturing firm of Hagen, of Cologne, uses for positive and negative plates a grid of hard lead of 0.12 in. thickness, with meshes 0.6 in. x 0.6 in., the surface of the plate is 5 ins. x 8 ins., the distance between two plates 0.12 in., the intermediate corrugated perforated ebonite plates have a thickness of 0.01 in.; the capacity is 4.5 ampere hours per pound, if discharged in 5 hours. The first of these batteries has been used in an automobile which has been in continuous operation since March, 1899; the automobile weighs 2640 lbs., and can run with a speed of 18½ miles per hour; at the end of April, 1900, the cells were cleaned, the negative plates were found to be fully intact, while the positive plates had lost some mass. The initial capacity of 120 ampere hours at a discharge in 5 hours had not decreased. The same type of batteries will be used in public automobiles in Cologne and Duesseldorf. In the laboratory the batteries gave about 300 discharges in 2 hours before they had to be replaced; so that in the practical automobile service at least 150 discharges may be supposed to be possible without any repairs. As the most expensive parts, the ebonite boxes and the intermediate ebonite plates, are not worn out, 30 per cent of the first cost of the cells is sufficient per year for repairs. Of 40 batteries, three did not keep in service the capacity that they had shown in the tests in the factory; it was found that in the negative plates a part of the active material had lost the contact with the grid, which could be explained only by intense cold to which the plates had been subjected before they were formed; this shows how carefully such plates must be manufactured. —*Centralblatt fuer Accum. und Elem. Kunde*, May 15.

REFERENCES.

*Calcium Carbide.*—KREFTING.—An article on the calcium carbide

industry of Norway. There are at present three plants in operation, which are supplied with power from water-power plants for a price of $11.25 to $12.50 per year and horse-power, which is very cheap, as the calcium carbide plants can be operated continuously during the whole year, day and night. More plants are in course of erection.—*Chem. Ind.*, vol. 23, p. 121; abstracted in *Zeit. fuer Elektrochemie*, May 24.

*Electrolytic Production of Metals.*—An illustrated description of an apparatus devised by Becker, for the production of metals by electrolysis of their fused salts or oxides, especially for the production of sodium and magnesium.—*L'Elec.*, May 19.

*Engraving by Electricity.*—FROMENT.—An illustrated description of the process, noticed in the Digest Jan. 13 and May 12.—*L'Elec.*, May 19.

RIEDER.—Another illustrated description of the same process.—*L'Ind. Elec.*, May 25.

*Chemical Action of the Effluvium.*—BERTHELOT.—An article on the combination of carbon sulphide with hydrogen and nitrogen under the action of the electric effluvium. It is chiefly of chemical interest.—*Ann. de Chimie et de Phys.*; translated in *Sc. Amer. Sup.*, June 9.

### UNITS, MEASUREMENTS AND INSTRUMENTS.

*Measuring Instruments for Alternating Currents.*—BENISCHKE.—An illustrated paper, describing instruments of the General Electric Co. of Berlin. They are of the dynamometer type, with magnetic damping. Magnetic damping has so far been supposed to be impossible in wattmeters of the dynamometer type, especially if they are to be calibrated with continuous current, because the damping magnet distorts the field in such a manner that no practical scale can be obtained, and because under the influence of the alternating current the permanent magnetism is diminished by and by, and therefore also the damping effect. If, however, it is intended to calibrate with alternating current, wattmeters can be constructed, which contain iron, therefore it was his first endeavor to improve the methods of calibrating so that wattmeters of the dynamometer type can be calibrated with alternating current. The general scheme of the instruments described is as follows: a movable coil mounted on an axle, the direction of which is determined by springs, is deviated under the influence of a fixed coil; for damping, the axle is provided with an aluminum disk, which oscillates between the poles of a permanent magnet; the whole dynamometer is surrounded by a laminated iron mantle of such a form that the magnetic lines of force are running through the iron mantle, and do not touch the damping magnets; the internal part of the instrument, where the movable coil is oscillating, is free of iron; the magnetic circuit is therefore far from being closed. The instruments described and illustrated are a voltmeter, a wattmeter and two ammeters. He shows that the indications of the wattmeter are practically independent of the angle of phase, as the ratio of the reactance and the resistance in the shunt coil of his wattmeter is very small; the wattmeter gives practically correct readings even with a very great phase difference in the main circuit, as in measurements of the no-load loss of transformers. The readings of the instruments are theoretically dependent upon the frequency, as the deviation of the movable coils depends upon the current in the same and this current upon the impedance and the reactance upon the frequency; but the reactance is extremely small, compared with the resistance, so that the impedance is practically equal to the resistance, and therefore independent of the frequency; hence also the readings of the instrument are practically independent of the frequency. He found that the differences between the readings for alternating current of 50 periods and for continuous current were very small, and concludes that if the influence of the frequency is so small, there can be practically no influence of the wave form. As the magnetic circuit is far from being closed, the magnetization of the iron mantle is very small, and there is practically no influence of the hysteresis.—In the discussion which was held on a following meeting, Franke questioned the practicability of calibrations with alternating current; in a wattmeter of somewhat similar construction, but with a more closed magnetic circuit, he has found that hysteresis caused extremely wrong results; he also said that it is difficult to get aluminum free of iron, and that therefore aluminum should be used very cautiously in magnetic fields. Benischke denied the influence of hysteresis in his instruments; he also said that in the meanwhile he has succeeded in making the difference between calibration of his ammeters with continuous current, and with alternating current so small, that it is now only about 0.2 per cent, so that the ammeter may be calibrated just as well with continuous current as with alternating current. With the voltmeter he obtained nearly as good results.—*Elek. Zeit.*, May 17.

*Frictionless Motor Meter.*—EVERSHED.—A very brief note on a paper read before the Brit. Inst. of Elec. Eng., in which he described his meter. The main points are the magnetic suspension and the absence of any top pivot. His magnet is placed above the spindle, which obviates any need of an upper bearing and reduces the pressure of the lower bearing on the jewel from about 250 grammes to 1 gramme.—*Lightning*, May 17; the former description, to which reference is made in this note, was in *Lightning*, Aug. 3, 1899.

An abstract of the discussion which followed this paper, and in which T. D. Lockwood, of the Bell Tel. Co., of Boston, participated. Ferranti thought that Evershed had not quite appreciated how frictionless other meters have been; he instanced a case when one of his own mercury meters ran backwards slowly for two days after being disconnected from the circuit; the cause was found to be that the sixth or seventh wheel in the train was jammed, and the spring on the other wheels was sufficient to give the driving force, so that the friction must have been extremely small; he thought the Evershed meter was of greater scientific than commercial interest, as it was rather complicated, and the customer wanted absolute simplicity. Mordey exhibited a Stanley meter, which he thought Evershed had not sufficiently appreciated; he said that in the future mercury meters for direct current and induction meters for alternating current would be the rule. Ayrton defended complexity; the Aron meter was complex, but sold enormously. Evershed replied that the question of complication was one for the maker, the user's only care was that the meter should work well and not break down.—*Lightning*, May 17; Lond. *Elec. Rev.*, May 18.

An article showing the points in which the Evershed meter is better than the Thomson-Houston meter. "The net result seems to be that while the great defect of the old meter—friction—is almost entirely eliminated, the other errors, which even then were not important, are largely reduced through the instrument being run at lower speeds."—Lond. *Elec. Rev.*, May 25.

### TELEGRAPHY, TELEPHONY AND SIGNALS.

#### REFERENCES.

*Simultaneous Telegraphy and Telephony.*—WALLOCH.—An illustrated translation of the German article noticed in the Digest Apr. 28.—*Tel. Mag.*, May.

*Japan.*—The first part of a historical and statistical summary of the development of the telegraph service in Japan.—*Jour. Tel.*, May 25.

*Toll Lines.*—HEDDON.—An illustrated article on the construction, equipment and operation of toll lines, in which he briefly discusses the relative merits of tamarack and cedar poles, of iron and copper wire, the transposing of circuits, a convenient form of test station apparatus, and the best forms of telephones and switchboards for toll lines.—*Tel. Mag.*, May.

*Telephone Switchboards.*—ARIZAN.—A long, illustrated article, describing the new types, used now in France.—*Jour. Tel.*, May 25.

*Pole Line Specifications.*—DOMMERQUE and DE LAND.—The first part of an article, giving the specifications which they have prepared for the Pittsburg Federal Telephone Co., for use when contracting for the construction of telephone trunk or toll lines.—*Tel. Mag.*, May.

### MISCELLANEOUS.

*British Patents.*—An editorial note on the annual report of the British Comptroller-General of Patents. The number of applications for patents has steadily diminished during the last two years, having reached its maximum of 30,592 in 1897, and fallen in 1899 to only 25,786. Also the number of complete patents sealed has decreased. On the other hand, the value at which patents are held does not appear to have diminished, for there were more 13 or 14-year-old patents last year than in previous years, showing that it has been found worth while to pay the fees to maintain more patents for their full life than hitherto.—Lond. *Elec.*, May 25.

#### REFERENCES.

*British Institution of Elec. Eng.*—A list of the elected Council and honorary officers for 1900-1901. President is Prof. J. Perry.—Lond. *Elec. Rev.*, May 25.

*International Society of Electricians in Paris.*—An account of the proceedings of the recent annual meeting, with the speeches of the retiring president, J. Violle, and the new president, Mascart. A. Hillairet was elected president for 1901-1902.—*Bull. de la Soc. Int. des Elec.*, April.

*Seasoning Timber.*—VECQUERAY.—An abstract of a paper read before the Institute of Mining Engineers of Great Britain, in which he described the Nodon-Bretonneau process of seasoning and preserving timber (Digest Feb. 25, Mar. 11, 1899; Jan. 6, 1900). The discussion is also briefly abstracted.—*Eng. News,* May 31.

D'ARSONVAL.—A French Academy note, describing the different apparatus used for the production of the brilliant electrical effects for the decoration of the front of the electrical palace. He uses the discharges of strong condensers, charged by transformers which are supplied by alternators. The transformers, condensers, etc., are described.—*L'Ind. Elec.,* May 10; *L'Elec.,* May 5.

SCHINDLER.—An illustrated description of a 50-hp, continuous-current, compound-wound motor, direct coupled to a mangle of German make exhibited at Paris.—*Elek. Zeit.,* May 17.

## New Books.

A BRIEF HISTORY OF MATHEMATICS. By D. Karl Fink. Chicago: The Open Court Publishing Company. 332 pages. Price, $1.50.

It is stated in the translator's preface that the writers of most handbooks of this character feel called upon to collect a store of anecdotes, to incorporate tales of no historic value and to minimize the real history of the science. Fink, on the other hand, omits biography entirely, referring the reader to a brief table in the appendix or to the encyclopedias. He systematically considers the growth of arithmetic, algebra, geometry and trigonometry, carrying the historic development somewhat beyond the limits of the ordinary course.

The author, in his preface, states that the object of the work is to give students of mathematics a historical survey of the elementary parts of this science, and to furnish the teacher of the elements opportunity, with little expenditure of time, to review connectedly points for the most part long familiar to him, and to utilize them in his teachings in suitable comments. The ground covered is divided into periods, as follows:

Arithmetic in three periods, the last extending from the 15th to the 19th century. Algebra in three periods, the last extending from the middle of the 17th century to the present time. Geometry in five periods, the last extending from Descartes to the present. Trigonometry in three periods, the last extending from the middle of the 17th century to the present. In general terms, the modern period in the history of mathematics is considered to begin with Descartes, Leibnitz and Newton, which period the author considers to be divided by Gauss into two parts—before Gauss, and with Gauss and after him. Footnotes give references to the various authorities in mathematical history, and an appendix gives brief biographical notes of the great names of mathematical science.

COMMERCIAL AND BUSINESS ASPECTS OF MUNICIPAL ELECTRICITY SUPPLY. A Practical Handbook for the Use of Electrical Engineers to Municipal Corporations and Members of Municipal Electricity Committees. By Alfred H. Gibbings. New York: The MacMillan Company. 270 pages. 57 illustrations. Price, $4.00.

This work advances no direct argument, either for or against municipal ownership, but treats it as an existing condition. The main object of the book, as stated by the author, is to show how the average length of daily loads at electric-generating stations may be increased and to point out uses to which electricity may be put, in addition to that of lighting. The positions of gas and electric energy in the lighting field are considered, and the conclusion reached that there is ample room for both. Some of the advantages incident to the business of interior electric wiring, when engaged in by towns or cities that operate electrical supply systems, are pointed out. The relation between the public rates charged for electric energy and the variable and fixed charges at the station are discussed, and the important influence of the maximum demand and of the times at which individual demands take place are brought out. Reasons for variations in the charges per electric unit are brought out, and some of the devices used at consumer's premises to determine their proper rate are described. Gas works are contrasted with those that produce electric energy, as to constancy of operation and the storage of their outputs.

Considerable attention is devoted to the influence of a day-motor load on the cost per unit of the total station output, and the advantages of electric motors for various power requirements are gone over. Reasons that tend to make the rates for electric energy at motors less than the rates at lamps are given; also comparisons between the cost of electric and other powers. The position is well taken that the station rates should be such for all service that an equal rate of profit is obtained in all cases. The rental of motors and arc lamps, by municipal corporations, comes in for quite a share of attention, and is evidently favored by the author. Satisfactory methods of storekeeping, by corporations, are pointed out and a number of forms suggested. Along this line the advantages of a supply store, apart from the generating plant, and located in a district favorable for retail trade are urged. Free wiring, or that erected on the consumer's premises by the corporation, for which only a rent is charged, receives more favorable attention, as a means to extend the operations of the electric plant, than most station managers in the United States will probably think it merits. The supply of lamps, for customers of the public plant, is discussed at some length, and the conclusion reached that the public rates should include with the electric energy all of the lamps necessary.

On the subject of high-voltage incandescent lamps, concerning which American managers and engineers might hope for valuable results from English practice, little is said. Some details of manufacture for these high volt lamps are briefly taken up, but their very important bearing on large problems of electrical supply is hardly noticed. Incandescent lamps are said to be cheaper than gas for street lighting, but the entire argument on this point rests on several assumptions which seem to have been made in order to insure the conclusion. Data covering the number of incandescent street lamps and the charges for same at various places is included. Quite an amount of space is devoted to the discussion and description of meters, particularly those of the prepayment variety.

One of the best parts of the book is that in which the effects on station loads, as to duration and amount, by extensions to residence districts, are considered. The last part of the work goes into some details as to various industrial operations, in which electric energy may be used, and suggests their possible value as future loads for electric stations. Though the author has constantly treated the public supply of electricity as a municipal enterprise, much of the work applies equally well to plants under private management.

While this book purports to be a discussion of the business side of electrical supply, its author has evidently been unable to forget that he is an engineer. Not content with having stated what has been, may be or should be done, he must frequently digress in order to show just how to do it. The result is not entirely happy, being a rather mixed discussion of broad business and engineering policy with technical details. So far as engineering features are concerned the book contains little that is new to the art, but some of the broader questions it raises are worthy of much more general discussion than they have generally received. The non-technical reader will make but poor headway in this work, but for the managing engineer it has valuable suggestions. Among its more valuable features is the incidental light it throws on the conditions of the electrical supply industry in England. A number of tables add to the value of the book. The binding is strong, the paper heavy, printing clear, and cuts good.

BOOKS RECEIVED.

OUR NEW PROSPERITY. By Ray Stannard Baker. New York: Doubleday & McClure Company. 267 pages. Price, $1.25.

MAGNETIC INDUCTION IN IRON AND OTHER METALS. By J. A. Ewing. Third edition, revised. New York: The D. Van Nostrand Company. 393 pages, 173 illustrations. Price, $4.00.

TRACTION ÉLECTRIQUE. Extrait des Leçons Professées a l'Institut electrotechnique Montefiore. Par Eric Gerard. Paris: Gauthier-Villars, Editeur. 136 pages, 92 illustrations. Price, 3.50 francs.

LECONS D'ELECTROTECHNIQUE GENERALE. Professées à l'École Superieure D'Electricite, par P. Janet. Paris: Gauthier-Villars. 614 pages, 307 illustrations. Price, 20 francs.

## Directory of Electrical Societies, Etc.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Next meeting, Paris, Aug. 16, 1900.

CANADIAN ELECTRICAL ASSOCIATION. Next meeting, September, 1900. Place to be selected.

NORTHWESTERN ELECTRICAL ASSOCIATION. Next meeting, Waupaca, Wis., June 26, 27 and 28, 1900.

AMERICAN STREET RAILWAY ASSOCIATION. Next meeting, Kansas City, Mo., Oct. 16, 17, 18 and 19, 1900.

NATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Next meeting, Pittsburg, Pa., Sept. 25, 26 and 27, 1900.

AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION. Next meeting, New York, Sept. 25, 26 and 27, 1900.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Next meeting, Detroit, Mich., June 20, 21 and 22.

NEW YORK ELECTRICAL SOCIETY. Annual meeting for election of officers, etc., College of the City of New York., June 14. Paper: "Late Advances in Ruhmkorff Coil Interrupters," by E. W. Caldwell.

## Automatic Telephone Pay Station.

The automatic telephone pay station, herewith illustrated, has recently been brought out by the American Toll Telephone Company, of Cleveland, Ohio, and is claimed to possess advantages over similar devices. The device is purely mechanical, having no electrical connections, and operating entirely independent of the telephone. The signal to the operator is made by a mechanical buzzer which can be heard through the telephone. The coin is placed on the horizontal slide shown, which is pushed into the box. The coin drops down a slide, tripping the buzzer, the spring of which having been previously wound by the act of pushing forward the slide. If the coin is a nickel, it is shown at the glass in the centre, but if a smaller coin, it falls through without tripping the buzzer. The hole in the slide is exactly the size and thickness of th nickel, so that it is impossible to use a mutilated coin. This is one of the strongest features claimed for the device, since slot machines are frequently thrown out of order by being clogged. Another feature claimed is that a steel slug the size of a nickel cannot be used, such being held immediately after entering the box by a permanent magnet. The slug cannot drop

AUTOMATIC TELEPHONE PAY STATION.

and is withdrawn with the slide. This is a particularly valuable feature, since a considerable proportion of the receipts from toll boxes in the past have been in the shape of iron or steel slugs and washers. It is also impossible to impose upon the machine by attaching a string to the coin, since after tripping the buzzer the coin cannot possibly be withdrawn. Each operation of the buzzer is registered by an automatic indicator, which serves as a check on the collector, since it can only be turned back by an authorized person. Each machine is equipped with a Yale lock. Should a duplicate key be made and money extracted, the fact would at once be disclosed by an indicator. The box is made of seamless steel, and it measures 7 ins. x 5 ins. x 6 ins. It can be attached to any instrument without change, and presents a neat appearance.

The company is also designing and will have ready for the market in the near future a similar device for toll stations with slides for coins of all denominations. These are to be made with a compartment at the base for the telephone battery, so that it is unnecessary to change the face of the instrument.

The American Toll Telephone Company publicly exhibited this device for the first time at the telephone convention in Cleveland this week.

## Ness Automatic Switch Telephone.

The telephone illustrated herewith is of the intercommunicating type, and is gotten up in very compact form. It is provided with the Ness automatic switch, the lever of which automatically returns to the home button when the receiver is hung upon the hook, the lever remaining in contact with the selected button so long as the wire is in use. This instrument is made in various forms, the hook and switching connections in all of them being mounted upon the door of the box, as shown in this cut. The smallest size of this switch contains 10 points, which, of course, can be used for any lesser number of sta-

AUTOMATIC SWITCH TELEPHONE.

tions. The connections are all cabled across the bottom of the box in such a manner as to permit the opening of the box without disarranging any of the circuits.

These instruments, which are made by the Holtzer-Cabot Electric Company, Brookline, Mass., are well constructed throughout, and are very serviceable in factories, offices, etc., for intercommunication between distant parts of the establishment. It does away with the necessity of a central station, each instrument being provided with equivalent switching apparatus. To communicate with a station all that is necessary is to set the lever on the corresponding button, or contact point, and when the conversation is ended the lever returns to the home point automatically, as already stated.

## "Phono-Electric" Wire.

A new line wire called "Phono-Electric" is being manufactured by the Bridgeport Brass Company, which company first produced, perfected and named hard-drawn copper wire. Up to the present time hard-drawn copper wire, and composite wires of copper and steel, have been the main reliance of engineers; but experience has developed the need of a wire that will more completely meet the practical conditions which are imposed by the exigencies of every-day service and upon which their value as working conductors depends, and the makers claim that "Phono-Electric" wire gives the best possible combination of strength, toughness and conductivity.

The manufacturers state that this wire has a tensile strength for the various sizes of wire, from 40 to 50 per cent greater than that of hard-drawn copper wire, and that its properties are absolutely permanent; that it is tough as mild steel, vastly more durable and four times as good a conductor. The wire is perfectly homogeneous, both in its mechanical and molecular structure, and does not depend on a hardened skin for its strength, as do other drawn wires. A series of tests were made on this point by removing successive strata from the surface of "Phono-Electric" wire, and its tensile strength was found to be uniform throughout its whole diameter. Hard-drawn copper wire was subjected to the same treatment, and it was found that once the skin is removed or injured in any way, the strength of the wire is reduced to that of ordinary soft copper. This difference is funda-

mental, and upon it depends the difference between the general properties of "Phono-Electric" and hard-drawn copper wires.

Moreover, the existence of a hardened skin gives to the various strata near the surface a condition of intense strain, which renders it quick to respond to any mechanical injury. It is claimed that the perfect homogeneity of "Phono-Electric" wire enables it to resist unusual strains without impairment of its tensile strength.

Equally important with tensile strength in a wire is the power of enduring severe strains without taking a permanent stretch, thereby weakening the wire for future emergencies. A set of comparative tests on this point showed "Phono-Electric" wire to have an elastic limit 40 per cent greater than that of hard-drawn copper wire. It thus will endure, without permanent elongation or injury, stresses under which hard-drawn copper wire would break. In resisting ice storms and extremes of temperature this high elastic limit is of great value.

Under ordinary circumstances great power to resist the weakening effects of twisting is not necessary for a conducting wire, although it measures, indirectly, but effectively, one of the most important properties a wire can possess—toughness. The torsional strength of "Phono-Electric" wire is well shown from the fact that a No. 14 "Phono-Electric" wire stood 120 turns in 6 ins., while hard-drawn copper wire of the same size and length broke at 47 turns.

This implies a quality which is not defined by tensile strength nor elasticity. It implies power to resist bending, kinking, wrenching, sudden blows and slow distortions without giving way. This extraordinary toughness of "Phono-Electric" is one of the most conspicuous practical merits. In electric railway work, especially, the trolley wire comes in for very hard service. At turnouts it often comes in for hard knocks from the trolley, all sorts of pounding and wrenching, to say nothing of occasional vicious arcing at curves and frequent heating from overloads and accidental short circuits. To stand up successfully under such a test, the trolley wire must not only be strong, but must be tough and ductile, and retain these properties under all the severe conditions of service.

It constantly happens that the passage of the trolley wheel is accompanied by small electric arcs, set up between the wheel and wire. These burn and roughen the surface, so that the action quickly goes from bad to worse. It results both in burning and scarring the trolley wire and in annealing parts of its surface. After a hard-drawn copper wire is exposed to the arcing of a trolley wheel, its hardened skin is destroyed and the weakened wire rapidly succumbs. This is the secret of the frequent breaking of the trolley wire at the curves, where there is heavy service, arcing being established by the flange of the trolley wheel.

"Phono-Electric" wire is claimed to be free from this serious difficulty, for it does not maintain an arc readily; and there is nothing about it to anneal. Its fusing point is high and it is free from constituents easily vaporized, hence does not furnish enough metallic vapor to keep an arc going. It is also claimed that "Phono-Electric" wire resists weather, salt-fogs and the action of corrosive fumes far better than copper or any substitute; and therefore is peculiarly adapted for use in situations where other wires rust or corrode. In short, for trolley wire in hard use, for long and difficult spans, and for telephone and telegraph lines in exposed and troublesome places, its properties make it superior to the usual drawn wire.

## Gas Engine Igniter.

With the growing use of gas and gasoline engines, the matter of ignition of the charge has been given renewed attention, this having in the past been one of the weak points. The outfit illustrated herewith, made by the Ziegler Electric Company, 141 Franklin Street, Boston, and known as the "Zeco" igniter, has been devised to obviate the defects of other systems and to insure absolute reliability of ignition.

The outfit consists of a generator, storage battery and spark coil, the latter two being mounted on a switchboard. The sparking current at the start is drawn from the storage battery, and subsequently the load is carried by the generator, which also keeps the battery in full charge.

The switchboard is of polished marble slate, 10 by 13 inches, and bears the coil, battery, switch and terminals. The storage cells, of which there are three, have a capacity to spark the engine continuously for 75 hours, if ever called upon to do so by an accident to the generator. The spark coil, which is specially wound to use with this battery and generator, produces a hot and full spark which, at the same time, is not destructive to the terminals.

The dynamo was designed for the special use to which it is applied. It is dust and waterproof, provided with self-oiling ring bearings, and may be belted to the engine, or driven by a buff-wheel in contact with the fly-wheel. The machine, as will be seen from the illustration, is of the magneto type. Closing a switch starts the engine, which stops when the switch is opened.

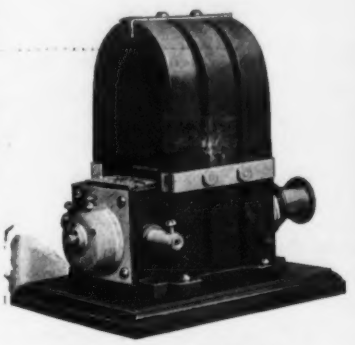


FIG. 1.—IGNITER DYNAMO.

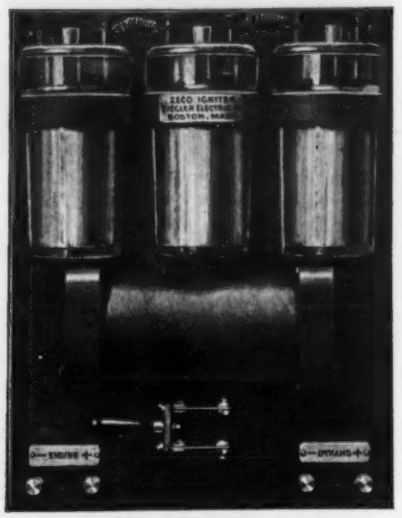
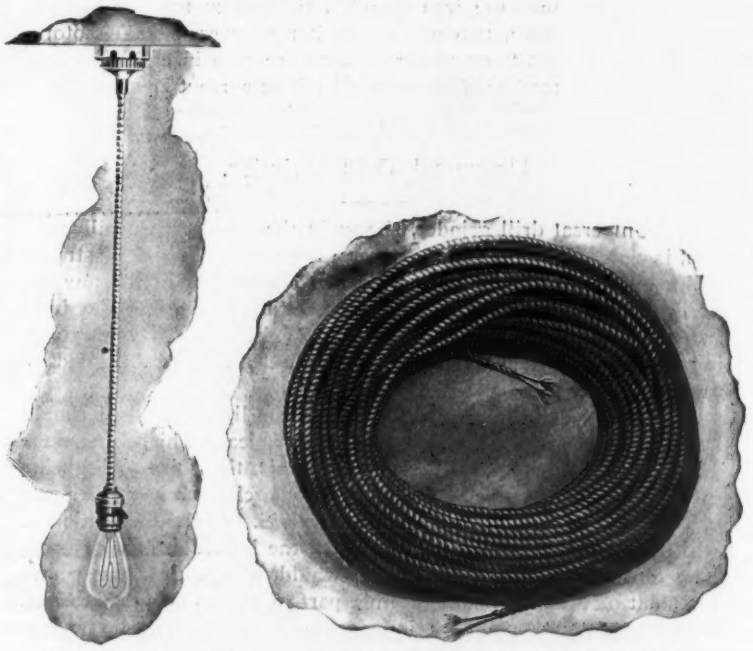



FIG. 2.—STORAGE BATTERY, INDUCTION COIL AND SWITCH.

## A New Flexible Conductor.

The Greenfield flexible steel armored conductors, represented in the several illustrations herewith, represent a late and radical advance in the art of electric wiring. Their use greatly simplifies the installation of electric conductors, no elbows being required and there being entire flexibility. Other advantages are due to the high grade of insulation which they insure, the perfect mechanical protection afforded by the steel armor, and the lower first cost when



FIGS. 1 AND 2.—STEEL ARMORED FLEXIBLE LAMP CORD AND CABLE.

compared with the metal conduits plus the conductors. Cables and cords are furnished complete with armor, or conductors sent to the manufacturers are armored, if insulated in accordance with the rules of the National Electrical Code.

The steel-armored twin-conductors are particularly appreciated on account of the ease with which they can be installed, especially in finished buildings for open construction, and "fished" wiring on the

loop system, in accordance with the requirements of Rule 24, Section "S," and Rule 48, Section "B," of the National Electrical Code.

The steel-armored flexible cord for lamp pendants and portables is made for use under all conditions requiring extraordinary service in such places as machine shops, theatres, mills, show windows, factories, engine and boiler rooms, etc., where flexible cords are almost

FIG. 3.—SECTION OF FLEXIBLE STEEL ARMORED CABLE.

indispensable, and where ordinary lamp cord is frequently useless on account of the exacting conditions of service. In marine or ship wiring, these flexible conductors have obvious advantages over the rigid conduit system, and are much superior to the "open wiring" hitherto used in mills and factories.

## Electric Power in Westinghouse Air Brake Company's Works.

The power in the works of the Westinghouse Air Brake Company, at Wilmerding, Pa., is now all furnished by electricity. A large central station has been erected at the works, and has been equipped with the most modern generating apparatus for this purpose. The plant consists of boilers of 2000 horse-power capacity, which furnish steam for three Westinghouse-Parsons steam turbines. Each one of these turbines is direct connected to a bi-polar, alternating-current generator, manufactured by the Westinghouse Electric & Manufacturing Company. The generators run at 3600 r. p. m., and deliver current at a pressure of 400 volts. There are also two exciter units, the air pumps and condensers for the turbines, driven by a 50-hp motor, and two air compressors driven by 100-hp motors. The exciters deliver current at 110 volts. All the motors are of the Westinghouse induction type, placed in the most convenient situations and belted to the original line shafts, which run at 112 to 175 revolutions, an increase of about 12 per cent in speed. Countershafts are largely dispensed with. In the machine shops there are motors aggregating 435 horse-power; in the boiler house, three motors, 60 horse-power; blacksmith shop, two motors, 50 horse-power; brass foundry, three motors, 35 horse-power; iron foundry, thirteen motors, 185 horse-power; leather room, two motors, 25 horse-power. Total motors, 48, aggregating 790 horse-power. There are 2500 incandescent and 60 arc lamps of 100 hours' capacity, all taking current at 110 volts.

## Universal Drill Grinder.

The Universal drill grinder, shown in the accompanying illustration, is claimed to be unique in several respects. The size illustrated will grind drills from ⅛ in. to 2½ ins. in diameter; will give any desired clearance to any drill at a single setting of the machine, irrespective of diameter, and give the point of the drill any angle ranging from 140 degs. to 75 degs., or from 22 degs. above the standard to 43 degs. below.

A requirement in drill grinding is that the lip of the drill should have the most clearance where the velocity is least, which is near the point or centre of the drill. To obtain this, the point while being ground must swing in the arc of a smaller circle than any other part of the lip in contact with the grinding wheel. In the illustration, it will be noted that the axis about which the holder swings or oscillates during the process of grinding would, if extended, pass nearer the point of the drill than any other part of the lip being sharpened. Consequently, the point or inner end of the cutting lip swings against the grinding wheel with a shorter radius of oscillation, and thus is given more curvature or clearance than parts nearer the circumference of the drill, which swings through an arc having less curvature. In this way the clearance is properly distributed along the cutting lip, and the full strength of the drill is preserved.

The drill holder has a short, rigid support journaled as near the grinding point as possible, thus decreasing the elasticity to a minimum and insuring a more equal grinding in the drill lips. For the sake of safety, speed and convenience, the drill holder can be drawn away from the grinding wheel while the drill is being placed, and quickly returned to its proper position. No chucks are necessary, the drill being simply dropped in a V-shaped holder which properly centres and locates each size. The angle formed by the sides of the holder is a right angle, the makers stating that years of experience have demonstrated this method of holding to be the most reliable and convenient.

A hardened steel rest at the grinding end of the holder determines the position of the drill lip. This can be moved laterally if desired, but when once set, it is right for all sizes of drills without further adjustment. That part of the holder which supports the shank end of the drill is quite narrow, and slides easily to accommodate large or other drills with shanks of square or odd shape, and is especially well adapted to that style which has a shank larger than the body on the drill itself. As the drill is supported near its ends, a large portion of it is always accessible, which admits of quick and positive handling; this also decreases any tendency to imperfect grinding due to slight crookedness of a drill. A joint at the end of the arm which supports the drill holder and operated by a horizontal handle, serves

UNIVERSAL DRILL GRINDER.

to bring the drill in contact with any part of the grinding surface of the wheel. It also serves as a positive and ready means of trueing the face of the wheel with a diamond, which can be placed in the drill holder.

Any desired clearance can be quickly obtained by turning a knurled index at the base of the holder. When this is once set for the particular clearance determined upon, it is right for all sizes of drills without further attention or adjustment. Any angle can be given to the point of the drill by simply clamping the drill holder at the desired inclination with reference to the face of the grinding wheel, this having no effect on any other function of the machine, even the lip-rest remaining in its original and proper position undisturbed. As the drill holder is oscillated it receives automatically a slight perpendicular motion. These combined movements give to the cutting end of the drill a helicoidal surface—the best possible shape. The adjustment for drills of various sizes is made by simply setting the caliper jaws at the left of the holder to the diameter of the drill to be ground. The drill described and illustrated is manufactured by the Washburn shops of the Worcester Polytechnic Institute, Worcester, Mass.

# NEWS OF THE WEEK.

## Financial Intelligence.

THE WEEK IN WALL STREET.—Stagnation was the chief feature in the stock market, and speculative hesitation developed prominently throughout the week. There seems to be no public participation in the stock market, what little business there was done being in the hands of smaller professional operators. Railroad earnings, compared with those of a year ago, continue very favorable, and it is thought that the contraction of activity and reduction of prices in the iron trade have remedied the situation in that quarter and that a change for the better is probable. Time money was freely offered at 3 per cent for short periods and 3½@4 for long. Commercial paper was dull, the offerings being small. The rates are 3½@4 per cent for double names. Call money was plentiful at 1¾@2 per cent. The general list of electric and electric railway stocks showed decided weakness and inactivity, being traded in rather lightly. Without exception, this class of securities suffered net losses in the week's trading, the only improvement noted being in the comparatively inactive stock of American District Telegraph. American District Telegraph closed at 25¼, a net gain of ¼ point; Brooklyn Rapid Transit closed at 68¾, a net loss of 3¾. The sales of this stock were 56,628 shares. General Electric closed at 132½, a net loss of 3½ points; Metropolitan Street Railway lost 2½ points net in the week's transactions, the closing price being 155. This stock reached 157 during the week, and dropped as low as 152¼; the sales were 8015 shares. Third Avenue Railroad closed at 111½, a net loss of 1½; the sales were only 975 shares. Western Union's closing quotation was 79¾, a net loss of ⅛point. The market for outside securities is still very quiet; the public remains away from it and even traders are showing no disposition to risk much. The quotations of active issues of outside securities are as follows: Electric Boat, 15; do., pfd., 34; Elec. Vehicle, 26; do., pfd., 60; General Carriage, 6¼; Ills. Elec. Vehicle Transp., 1¼; New England Elec. Transp., 3; New York Elec. Vehicle Transp., 7½; Otis Elevator, 28; Telephone, Telegraph & Cable of America, 4. Of the inactive list, Hudson River Tel. is quoted at 120. In Philadelphia, Electric Co.of America was dull Closing quotations were as follows: American Railways, 5½; Brooklyn Gas & Electric, 3; Cons. Traction Company (of New Jersey), 58; Cons. Traction Company (of Pittsburg), 26; Electric Storage Battery, 81; do., pfd., 90; Electric Company of America, 10⅛; General Elec. Automobile, ⅛; Philadelphia Electric, 4; Phila. Traction, 96¼; Union Traction, 38⅝. Boston closing quotations were: American Bell Telephone, 300; Erie Telephone, 100; New England Telephone, 129; Westinghouse Elec., 42; do., pfd., 62; Mass. Electric, 22; do., pfd., 76½.

GRAND RAPIDS RAILWAY BONDS.—The Grand Rapids Railway Company has acquired and now owns and operates all the street railway lines of Grand Rapids, Mich., consisting of over 50 miles of single electric track. Its gross earnings for the year ended April 30, 1900, were $486,161 as compared with $420,382 for the previous year, and $374,691 for the year before that. The net earnings for the year ended April 30, 1900, were $215,208. The company has recently been authorized to issue $3,500,000 5 per cent bonds, and has issued $2,500,000, dating them June 1, 1900, payable in 16 years. These bonds are being offered by Messrs. N. W. Harris & Co. at 103 and interest, at which price they net the investor a trifle over 4.70 per cent.

METROPOLITAN REPORT.—The report of the Metropolitan Street Railway Company for the quarter ending March 31 showed gross earnings of $3,268,260, an increase of $418,356, and net earnings $1,715,824, an increase of $313,557. After deducting charges for the quarter the surplus remaining was $729,398, an increase of $221,847. It is stated that on this basis, providing the other quarters of the year showed no larger surplus, the company would fall short of earning the full 7 per cent dividend upon the existing capital of $52,000,000. The quarterly statement showed cash on hand, $2,126,914, and profit and loss surplus, $1,521,581.

LACLEDE POWER COMPANY.—A meeting of stockholders of the Laclede Power Company, St. Louis, is called for July 26, when a proposition will be voted on to increase the capital stock of the company to $800,000. The increased capitalization has been agreed to by the stockholders of the company for the purpose of erecting a new power house of 4000 horse-power and extending the business of the Company. As the principal stockholders in the Laclede Power Company are also stockholders in the Laclede Gas Company and also in the Missouri-Edison Electric Company, it is likely that a division of territory and business will be arranged.

THE ERIE TELEPHONE ANNUAL REPORT.—The annual report of the Erie Telegraph & Telephone Company, for the year ending Dec. 31 last, shows the following results: Total income, $966,039; net income, $483,278; dividends, $225,000; total surplus, $1,429,131; undivided surplus of sub-companies, due the Erie Company to December, 1899, $1,009,635; total surplus December, 1899, $2,438,767.

GENERAL ELECTRIC DIVIDENDS.—By order of the Board of Directors of the General Electric Company, Secretary Westover announces that on July 14 next a dividend of $1.50 per share will be paid to holders of common shares, and a dividend of $3.50 per share will be paid on the same day to holders of preferred shares.

POSTAL CAPITAL REDUCED.—The Postal Telegraph-Cable Company of New York City has filed with the Secretary of State a certificate of reduction of capital stock from $1,000,000 to $100,000. The paid-in capital of the company is $1,000,000 and the debts and liabilities of the company are less than $5,000.

DIVIDENDS.—The directors of the American Steel & Wire Company have declared a regular quarterly dividend of 1¾ per cent on the preferred stock, and voted to distribute the second installment of 1¾ per cent on the common stock.

BONDS LISTED.—The Philadelphia Stock Exchange has listed $3,317,000 consolidated gold 5s of the Paterson & Passaic Gas & Electric Company.

THE COMMERCIAL CABLE COMPANY has declared the regular quarterly dividend of 1¾ per cent, payable July 3.

## Commercial Intelligence.

THE WEEK IN TRADE.—In summarizing the condition of trade, Bradstreet's says that new business at wholesale is of a between-seasons character, but warmer weather has offered a stimulus to retail business in some sections. That a heavy volume of business is being transacted in the country at large is evident in the very considerable gains over a year ago, noted in railway gross earnings. Purely mechanical failures are relatively few in number, and bank clearings show a rather less marked falling off from last year. Business failures for the week number 184, as compared with 135 last week, 178 in this week a year ago, 221 in 1898, 256 in 1897 and 234 in 1896. Failures are down to a minimum as regards number, but a few large embarrassments in widely separated sections and lines of business swelled the aggregate of liabilities in May beyond those of April or of those a year ago. Telegraphed reports to Bradstreet's indicate 713 mercantile failures during the month of May, with liabilities aggregating $8,159,571 in number. Failures are fewer by 1 per cent than in May a year ago, 27 per cent less than in May, 1898, and one-third less than in May, 1897. Liabilities show an increase of 38 per cent over May last year, but a falling off of 22 per cent from May two years ago, and of 40 per cent from the same month of 1897 and 1896. Compared with April, liabilities are 12 per cent heavier. Failures are more numerous in the Eastern, Middle and Pacific groups of States this year than last, the only important increases, however, are in New York State, owing to a larger number of small failures in the metropolis. As regards liabilities, it might be stated that the Southern States show only about half the damage there was in May a year ago, while in the Territories liabilities are only about one-fourth what they were last year. On the other hand, liabilities in the Middle States are about double what they were in May, 1899. The copper market was for the most part very dull, and with the rest of the market showed net losses at the end of the week. Amalgamated Copper sold down to 87½, and though it recovered fractionally on Saturday showed at the close a net loss of 2¼ points. This group of stocks was unfavorably affected by the announcement of a further cut in the price of copper. Manufacturers are fairly busy, but buy only for immediate needs. Lake is quoted at 16c.; electrolytic in cakes, wire bars and ingots, 15⅝@15¾c.; in cathodes, 15⅜@15½c.; casting copper, 15⅝c. European consumers, according to London mail advices, continue to buy with great caution. A conservative copper producer is quoted as saying: "Prices for copper are purely fictitious. I do not think any great amount of copper could be purchased at quoted prices. It looks as if 17c. would be the price for July and August delivery." Exports so far this month continue on a large scale and give evidence of a strong foreign demand. Shippers of copper from

the western mines are sending large quantities East, and some of the principal producers are said to be still behind on their deliveries.

PLANT FOR THE MANCHURIAN RAILWAY.—V. A. Kajevnikoff, chief engineer of the mechanical department of the Chinese Eastern Railroad, is at present in New York for the purpose of placing important contracts for tools, etc., to be installed in the various machine shops situated at Harbin, Manchuria, where the headquarters of the road are. Electrical power will be utilized for driving many of the American labor-saving devices which it is proposed to use. The Russian engineer also intends to purchase a complete plant for the lighting of the extensive shops. On his previous visit last fall, when he was accompanied by M. Kishevitch, the electrical expert attached to the mechanical department of the Chinese Eastern system, a substantial order for the general lighting of the road was secured by the Westinghouse Electric & Manufacturing Company. M. Kajevniffoff, who is unaccompanied on this occasion, is stopping at the Hotel Majestic, where he expects to remain for the next two months.

NEW CUBAN TARIFF.—The amended Cuban tariff which went into effect June 15, imposes a duty of 20 per cent on electric lighting, electric railway, telephonic and telegraphic apparatus and storage batteries, with the exception of telephones, the duty on which is 25 per cent. Electric elevators pay 20 per cent, and street cars and automobiles 25 per cent, the latter being also the rate of duty on scientific apparatus. Carbons are $3 per 100 kilograms, and glass insulators $1, and porcelain insulators $5.80 for the same weight. The rate for incandescent lamps is 2½ cents apiece, mounted or unmounted. Electrical conductors of one or more insulated wires are subject to a duty of $7.50 per 100 kilograms.

THE TREASURY BUREAU OF STATISTICS has prepared a list showing the principal exportations to Cuba, Puerto Rico and the Hawaiian and Philippine Islands during the ten months ending April, 1900. In this list we find that exports of electrical apparatus to Cuba were valued at $132,612; to Puerto Rico, $11,914; to Hawaii, $100,335, and to the Philippines, $10,083. Electrical machinery to Cuba, $52,112; to Puerto Rico, $1,698; to Hawaii, $5,230; to the Philippines, $85,433. The total exportations to Cuba amounted to $22,006,973; to Puerto Rico, $3,052,971; Hawaii, $11,601,720; the Philippines, $2,152,944. The list contains the names of 95 articles exported.

THE NATIONAL TUBE COMPANY has completed plans for one of the largest and most complete open-hearth steel and rolling mill plants in the country, that will cost $2,000,000. The plant will be erected at once at Benwood, Pa. An official of the company, in a recent interview, made the statement that the company's domestic business is still good, and its foreign trade is picking up. It has placed orders in the Transvaal, which business was interrupted by the war, and now that the war is over, the orders will be filled.

A BELGIAN ELECTRICAL PLANT.—The Council of St. Gilles, Brussels, Belgium, will receive tenders for the installation of an electric light and power plant to serve a portion of its territory. The conditions of contract for the plant may be obtained on payment of 3 francs, by addressing the Secretary of the Council at 14 Parvis Street, St. Gilles, Brussels, Belgium. Plans and tenders should reach the office of the secretary before 2 p. m. of Sept. 19.

PURCHASES FOR MEXICO.—The City of Mexico Tramways Company, Limited, has just decided on the awarding of some further contracts made necessary by the proposed extension of its road. Gillett, Herzog & Co., of Minneapolis, will supply the structural material for a car shed. The contract is said to amount close on $30,000, A 750-hp boiler equipment, consisting of three boilers of 250 horse-power each, is to be furnished by the Babcock & Wilcox Co.

ELECTRIC CARS FOR HONOLULU.—General Manager C. G. Ballentyne, of the Honolulu Rapid Transit & Land Company, has arrived in St. Louis. His mission is to purchase additional rolling stock for his road, which is equipped entirely with products of the American Car Company of St. Louis. The business of his road has increased to a large extent during the two years that the road has been in operation.

WIRE EXPORTS.—During the month of May the American Steel & Wire Company exported over 2800 tons of wire, 1367 tons going to Buenos Ayres, which was the largest buyer.

THE AMERICAN BRIDGE COMPANY.—It is reported that the American Bridge Company has decided to locate its headquarters in New York City, at 100 Broadway. W. H. McCord, formerly of Post & McCord, of New York, has been appointed vice-president in charge of the structural steel work for office buildings, armories and other large structures. Charles McDonald is vice-president, in charge of railroad bridge construction; Frank Conger is vice-president, in charge of road and highway bridges, and Charles M. Jarvis is vice-president, in charge of the operation of the 28 constituent companies. The chief engineer, C. C. Snyder, formerly of the Pencoyd Bridge Company, is vice-president, in charge of the engineering department. All of these officials will have their offices in New York. The executive officials, consisting of Percival Roberts, Jr., president of the company; J. A. Hatfield, assistant president; W. H. Connell, treasurer; Charles C. Price, auditor, and Douglas O. Morgan, secretary, will also be located in New York. It is stated that there will be no changes for many months in the operations of the constituent plants of the new company.

THE TRIUMPH ELECTRIC COMPANY, Cincinnati, has done a remarkable business in power machinery during the month of May and the first week in June. One of its contracts was for a generator and motor to operate coal-mining machinery at Rendville, Ohio. The order calls for installation by the first of August. A telegram received at this writing by Mr. Jacobs, of the Triumph Company, from Kansas City, calls for a big generator for operating a car and foundry shop there. This company has just finished the installation of a big power plant at the Globe-Wernicke Company's new establishment at Norwood. It is a 600-hp machine, with motor equipment, to be used to drive the machinery in this large plant. Two machines were also ordered from the Chicago agents of the Triumph Company (100 kilowatts each), for a power and lighting plant in a large business block in that city. Another order is for two 75-kw direct-connected generators for the Cole Estate in St. Louis. Two direct-connected machines of the same type were ordered for the Mt. Vernon Fuel Company, in Mt. Vernon, Ohio.

TAYLOR TURBINES.—The Taylor Manufacturing Company, of Lynchburg, Va., has bought the Risdon Water Wheel Shops, at Mt. Holly, N. J., including real estate, buildings, tools, patterns, records, etc., and will immediately start it up to full capacity for the purpose of taking care of orders on hand for turbines. The Taylor Company is now undergoing reorganization, and will assume the name of the Jno. W. Taylor Manufacturing Company, with a paid up capital of $500,000. One hundred and fifty thousand dollars will immediately be spent in new machine tools and other improvements, and when completed the Taylor plant will be one of the most complete and up-to-date water-wheel shops in the world. In addition to the manufacture of Taylor sleeve-gate turbines, some improvements will be made in the Risdon wheel, and its manufacture resumed.

AMERICAN COAL IN AUSTRIA.—The firm of Fr. Buzzi d'J., Trieste, Austria, has asked the Bureau of Foreign Commerce at Washington for the addresses of "the largest and most responsible coal collieries in Virginia, Pennsylvania, Alabama and Ohio." They are in possession of several names of coal-export firms in New York and Baltimore, but steamship companies and customers there, they say, prefer to deal with the collieries direct.

MANHATTAN'S NEW POWER HOUSE.—The Manhattan Railway Company proposes to equip its new power station with forced draft apparatus driven by alternating-current motors. It was originally intended to use direct-current motors in this work, but the plans have been recently changed. The company is yet in the market for coal and ashes conveying apparatus.

THE NEW YORK LIGHT, HEAT & POWER COMPANY is preparing specifications for condensers, coal and ashes conveying machinery, pumps, etc., for its new "Waterside" station, now building on the bank of the East River, between Thirty-eighth and Thirty-ninth streets. The steam and electrical equipments for the new station have already been ordered.

NEW STEEL PLANT.—The Park Steel Company has commenced work on the erection of a new plant at West Elizabeth, Pa. All of the necessary equipment has been purchased. The power plant will include six Babcock & Wilcox water-tube boilers of 250 horse-power each. The buildings will be equipped with Morgan electric traveling cranes.

UNDERGROUND CONDUITS.—Sealed proposals are invited to furnish 50,000 ft. of "special duct pipe" for the use of the Electric Commission of Baltimore. Further information may be had upon application to Charles E. Phelps, Jr., chief engineer of the commission.

ENGINE FOR ST. LOUIS PLANT.—Messrs. J. G. White & Co., New York, have purchased a 2250-hp vertical cross-compound engine for the Imperial Electric Company's new plant in St. Louis. The engine comes from the Fulton Iron Works, St. Louis.

MESSRS. GOULD & EBERHARDT, Newark, N. J., have recently sold four large shaping machines to the Lorain Steel Company, to be installed in the new addition to the machine shop.

THE JARVIS ENGINEERING COMPANY, Boston Mass., has secured the contract for the new power house of the Bristol County Railway Company, at Attleboro, Mass.

ELECTRIC HOISTS.—Sealed proposals for electric hoists will be received at the United States Engineer Office, Washington, D. C., until noon, July 5, 1900.

# General News.

## THE TELEPHONE.

SCOTTSBORO, ALA.—B. F. Thompson and W. B. Hunt are planning to put in a telephone system here.

ARLINGTON, ORE.—The Lost Valley Telephone Company is building a line between Arlington, Ore., and Lost Valley.

AUSTIN, TEX.—The Excelsior Telephone Company, of Wills Point, Tex., has been incorporated with a capital stock of $6,000.

GEORGETOWN, S. C.—The Telephone & Telegraph Company has begun to install a new system in this city. F. Rhem is president.

WILMINGTON, DEL.—The South Suburban Telegraph & Telephone Company, of New York, has been incorporated here. Capital, $250,000.

GORDONSVILLE, VA.—The Louisa Telephone Company has nearly completed its line from Gordonsville to Liberty Mills, in Orange County.

ABERDEEN, S. D.—The Dakota Central Telephone Company, of this city, has bought the local exchange at Watertown, and will enlarge and improve the same.

MILWAUKEE, WIS.—The Wisconsin Telephone Company reports a net gain of 376 subscribers in May, making a total number of 18,354 subscribers on May 31.

CLEVELAND, OHIO—The Central Union Telephone Company is putting additional metallic circuit lines between Cleveland, Painesville, Ashtabula and Chardon.

BOSTON, MASS.—The bill for State supervision of telephone and telegraph companies, passed by the House recently with little opposition, has been rejected on reconsideration.

OSHKOSH, WIS.—The Wisconsin Telephone Company will place all of its wires underground in the business sections of the city if the council will grant it the right to do so.

DESHLER, OHIO.—The Deshler Telephone Company has been incorporated. Capital, $10,000. Incorporators: F. D. Prentis, O. Higgins, H. C. Meeker, J. C. H. Elder, S. Cottingdam.

FULTON, MO.—The Fulton Telephone Company, of Fulton, Mo., has been incorporated with a capital of $20,000. The incorporators are J. V. Kemper, J. W. Jacks, A. E. Kemper and others.

ST. PAUL, MINN.—The capital stock of the Northwestern Telephone Exchange Company has been increased from $4,000,000 to $6,000,000. The money will be used in completing improvements.

LAKE CREEK, TEX.—The Southern Telephone Company, of Lake Creek, Delta County, has been chartered. Capital stock, $2,000. Incorporators: R. W. Miller, W. W. Thompson, J. C. Hendricks and others.

PENNVILLE, IND.—The Citizens' Telephone Company has been organized at this place. The new company will connect with all towns around, including Bluffton, Montpelier, Portland, Hartford City and other towns.

SOUTH BEND, IND.—The Central Union and the Long Distance Telephone companies have lost much wire by theft in Northern Indiana. The copper wire is taken after being strung. Joseph Neddo has been placed under arrest.

MARION, OHIO.—The Marion County Telephone Company has been incorporated with a capital stock of $50,000. Incorporators: Judge Caleb H. Norris, Hon. D. R. Crissinger, Oscar Wollenweber, J. W. Scott and French Crow.

BALTIMORE, MD.—The Chesapeake & Potomac Telephone Company has won its fight against the city as to the right of constructing underground distribution and make house to house connection therewith by means of poles.

MADISON, ILL.—The Kinloch Telephone Company has been granted a franchise. The charge for St. Louis service for business will be not more than $100 per year, for private use $60, for local business $50, and for local residences $30.

COLUMBUS, OHIO.—The United States Telephone Company, of Cleveland, is building a toll line from Columbus through Lancaster to Athens. New independent exchanges are under process of construction in all three of the cities mentioned.

RISING SUN, IND.—Right of way has been granted to E. W. Swarthout, president of the Belt Telephone Company, to construct his line from this city to Vevay, thus making a complete line from Cincinnati to Louisville on the east side of the Ohio River.

RONCEVERTE, W. VA.—The Greenbrier & Organ Cave Telephone Company has been organized here. Capital, $50,000. Incorporators: M. A. Gates, J. H. Crawford, R. A. Level, B. F. Mann, A. E. Johnson, all of Ronceverte; C. P. Nickell, attorney, Sinks Grove.

CEDAR RAPIDS, IA.—The Central Telephone & Telegraph Company, of Cedar Rapids, filed articles of incorporation. The capital of the company is $500,000, and the incorporators are A. T. Averill, A. H. Gale, Glenn Averill, J. C. Cook and E. M. Scott.

ATTICA, OHIO.—The Attica Telephone Company has been incorporated with a capital stock of $2,500. The following officers were elected: President, F. C. Myers; vice-president, John Schottler; secretary, H. G. Blaine; treasurer, R. T. Hearson; manager, E. S. Blaine.

EVART, MICH.—The Citizens' Telephone Company, of Evart, has been organized. The officers are: C. H. Rose, president; E. F. Birdsall, vice-president; C. E. Bell, secretary and treasurer; C. H. Rose, E. F. Birdsall, C. E. Bell, S. D. Lancashire and F. B. Smith, directors.

STEVENS POINT, WIS.—Articles of incorporation of the Almond Telephone Company were filed here on June 8. The capital stock is $5,000. The incorporators are F. Y. Frost, E. S. Cooper, J. A. Bowden, J. H. Johnson, W. C. Fisher, Stewart Hicks and David Hicks.

PORTLAND, ORE.—The Oregon Telephone & Telegraph Company will speedily complete a telephone line from North Yamhill to Tillamook. From the latter point a line will be constructed up the coast to Seaside, where it will connect with the Portland, Astoria and Seaside line.

FORT WAYNE, IND.—The Common Council has ordered all overhead wires to be put underground in what is known as the central district. The action is especially directed at the Bell Telephone Company, which has a franchise in this territory and continues the use of unsightly poles.

GENEVA, IND.—The Geneva Telephone Company, just organized in this city, will be sub-licensed by the Central Union Telephone Company. An exchange will be immediately put in. The officers are: A. G. Briggs, president; W. B. Hale, secretary, and H. M. Aspy, general manager.

BOSTON, MASS.—The report of President Glidden, of the Erie Telegraph & Telephone Company, read at the recent annual meeting, shows that the number of subscribers increased during the year from 62,850 to 106,558; exchanges increased from 307 to 345; total miles of wire, 196,349.

KANSAS CITY, MO.—The Missouri Interstate Telephone Company has been incorporated. Capital, $500,000. Incorporators: D. J. Dean, J. R. Crowe, L. C. Boyle, all of Kansas City; W. B. Hurst, C. W. Penniman, G. Hornaday, all of Fort Scott, Kan.; L. C. Bayle, attorney, Kansas City.

INDIANAPOLIS, IND.—The school board of this city has entered into a contract with the New Telephone Company for telephones in the library and school buildings at $18 per year for each instrument. The Central Union bid $21.50 and the New Company wishes it had bid a little higher now.

MIDDLETON, OHIO.—The American Rolling Mill Company of this place is installing a complete telephone system throughout its new works. There are 12 stations in the system just started, and more will be added from time to time. The Lawton-Beattie Company, of Cincinnati, has the contract.

TONAWANDA, N. Y.—The Tonawanda Home Telephone Company has been incorporated to operate in North Tonawanda, Tonawanda and Kenmore, and in several towns of Niagara and Erie counties. Capital, $100,000. Directors: Albert R. Smith, of North Tonawanda, and George H. Frost, of Buffalo.

HOPKINSVILLE, KY.—The new telephone line between this city and Weaver's Store, Tenn., is finished and in operation. The line is 25 miles in length and connects with the towns of Beverly, Howell, Herndon, Bennettstown and Lafayette. A number of other Tennessee towns will shortly be added to the line.

CHARLEROI, PA.—The Councils of the borough of Charleroi, Pa., have granted a franchise to the Pittsburg & Allegheny Telephone Company to erect poles and construct lines of wire for the purpose of installing a new telephone line in that vicinity. The company expects to have the line completed within nine months.

PITTSBURG, PA.—The new local telephone company, known as the Pittsburg & Allegheny Telephone Company, expects to have 3000 instruments in use in this city by July 1. The exchange building is complete; 1200 poles have already been put up, the lines have been strung, the houses of subscribers wired, and all that remains to be done is the finishing up a few minor details to make the system complete.

DETROIT, MICH.—Drs. J. E. Clark, E. B. Smith and other prominent physicians are behind a movement to organize a telephone system in Detroit for the especial benefit of doctors and druggists, who feel indignant at the treatment they are getting from the telephone company. The enforced use of nickel-in-the-slot machines in drug stores has stirred up a great deal of dissatisfaction, and the service is said to be bad in other ways.

GREENVILLE, OHIO.—The Home Telephone Company of this place has been organized by the election of the following officers: J. A. Ries, president; George W. Hartzell, vice-president; C. R. Leftwick, treasurer, and T. C. Maher, secretary; directors, J. A. Ries, C. R. Leftwick, C. A. Kipp, F. H. Schermund, L. J. George and W. D. Rush. The company has secured a franchise and will commence construction work in the near future.

JEFFERSON CITY, MO.—The Capital Telephone Company has awarded the contract for putting in and equipping its plant with 400 telephone instruments to the North Electric Company, Cleveland, Ohio. The company has secured contracts for 400 telephones and will start the exchange with that number. It has the material on the ground and will begin at once to put in the plant. It has contracted to place telephones for residences at half the price the present company charges.

CHARLES CITY, IA.—H. J. Fitzgerald, president of the Northwestern Telephone Company, has sold the issued stock of his company to Mr. C. A. Averill, president of the Cedar Rapids National Bank, and also president of the Central Telephone & Telegraph Company. The sale covers the exchange at Charles City and Osage, and about 250 miles of toll line and other property of the company. The Northwestern at the present time will continue under its present name and present operation.

CHICAGO, ILL.—The independent telephone interests of Illinois, represented by 50 delegates to the annual convention of the Illinois Telephone Association, Dr. I. A. Lumpkin, of Mattoon, president, decided that long-distance toll lines to connect the independent exchanges in Southern Illinois towns with St. Louis would be constructed. These officers were elected: President, Dr. I. A. Lumpkin, Mattoon; vice-president, F. H. Stamper, Benton; secretary, W. B. Burt, Decatur; treasurer, E. P. McConnell, Chicago.

SACO, ME.—An independent telephone company has purchased the existing rights and line of the Saco & Biddeford Telephhone & Telegraph Company, and proposes to begin business in Saco, Biddeford, Old Orchard and Biddeford Pool in the near future. The new company is composed of George F. West, of Portland; Carlos Heard, E. W. Staples, Jere G. Shaw, Charles H. Prescott and Charles E. Atwood, of Biddeford; Hampden Fairfield, Luther R. Moore, A. G. Prentiss and Herbert R. Jordan, of Saco.

BALTIMORE, MD.—The Chesapeake & Potomac Telephone Company instituted another suit in the Circuit Court to restrain the city from interfering with operations of the company. The company now asks an injunction restraining any interference in the construction of conduits, under the supervision of the city engineer. The proposed conduits are to be used by the company in connec-

tion with its Madison Avenue exchange. The mayor and City Council, ex-Mayor W. T. Malster and Marshall Samuel T. Hamilton filed a supplemental answer in the Circuit Court to the bill filed some time ago by the Chesapeake & Potomac Telephone Company. The answer alleges that ordinance No. 41, approved May 9, 1889, upon which the Telephone Company relies, was based primarily upon the consideration that the company, for privileges granted, was to remove within the period of two years from the date of the approval of the ordinance, as rapidly as conduits were constructed and cables laid therein, all poles belonging to the company standing along the route of such conduits.

## ELECTRIC LIGHT AND POWER.

MONTPELIER, IND.—The Montpelier Electric Light Company has been incorporated with a capital stock of $50,000.

MECHANICSBURG, OHIO, is open for bids on water works, electric lights and gas until July 12. Specifications can be had on application to the city clerk, E. L. Byers.

RIVER FALLS, WIS.—This city has voted bonds to the extent of $8,000 for an electric lighting plant. It will be operated by water power. The cost of the plant will be about $17,000.

ATLANTA, GA.—The council has adopted an ordinance granting the Atlanta Railway & Power Company the right to lay conduits for the transmission of electricity for light, heat and power.

SENECA, S. C.—The Oconee Manufacturing Company has been commissioned, with a capital stock of $100,000. The company proposes to develop and transmit electric power and operate a cotton mill.

GOLDSBORO, N. C.—The Goldsboro Illuminating & Traction Company has been organized and a charter applied for. If the new company cannot purchase the existing plant a new electric plant will be built.

LAURENS, S. C.—M. B. Poole, Dan Yarborough and others have offered the Yarborough mill shoals and 200 acres of land toward the developing of the water power of the river. The shoals are 10 miles from this place.

PHILLIPS, ME.—The Rangeley Electric Light & Power Company has been organized at Phillips, with $25,000 capital. The officers are: President, F. E. Timberlake, of Phillips; treasurer, H. A. Furbish, of Rangeley.

DULUTH, MINN.—An ordinance has been introduced in the City Council to provide for the issuance of $110,000 of light bonds, to erect a municipal electric light plant. This was voted on favorably by the people last winter.

DAVENPORT, IA.—The Consumers' Gas & Electric Company, of Davenport, has been incorporated. Capital, $300,000. Incorporators: J. R. Nutting, A. Steffen, E. H. Ryan, T. Scott, S. F. Smith, J. W. Walsh, all of Davenport.

IRWIN, PA.—The Irwin Electric Light & Power Company, the Jeannette Electric Light Company and the Manor Electric Company have been sold to Greensburg capitalists, headed by E. E. Robbins and M. L. Painter, for $175,000.

MANNING, S. C.—The Manning Oil & Illuminating Company, with a capital stock of $30,000, has been commissioned, and proposes to establish an electric plant and oil mill. The incorporators are: A. Levi, T. F. Bradham and F. P. Ervin.

SULLIVAN, IND.—The Sullivan Electric Light & Power Company has been incorporated with a capital stock of $25,000. The directors are: Asa Stewart, C. H. Crowder, W. H. Crowder, P. L. Reid, E. S. Crowder, J. W. Maley and Henry Rost.

APPLETON, MINN.—The contract for electric light and water works plant has been let. Myron & Rieffer, of this place, got the contract for the power house and well. The remainder of the contract was let to outside parties. The plant will cost about $14,000.

COLUMBUS, OHIO.—Mr. John Young, a representative of the Western Electric Company, of Chicago, has submitted some figures approximating the probable cost to the city of installing a municipal electric light plant sufficient in capacity to light the entire city.

PERU, IND.—Ulen & Parrott, of Indianapolis, have taken charge of the Peru Electric Light & Power Company's plant, and will hold it for 10 years, receiving $6,000 annually from this city for street lighting, and at the expiration of that time will give the plant to the city.

SAN FRANCISCO, CAL.—The Keswick Electric Light & Power Company was recently incorporated. Principal place of business, San Francisco. Directors: H. D. Scribner, A. F. Johns, P. S. Coke, H. C. Donnels and W. H. Bone, of San Francisco. Capital stock, $50,000.

TALLADEGA, ALA.—The city of Talladega will buy the property and franchises of the Talladega Light & Water Company for $45,000. This arrangement has been made with the receiver of the company. It is understood the city will put in a modern electric lighting system at once.

LOCKVILLE, N. C.—The Cape Fear Power Company is surveying the water power here, which is one of the finest in the State, preparatory to developing it and transmitting electric power to the towns of Fayetteville, Sanford, Jonesboro and other points. William Morgan is president of the company, and R. P. Gray, secretary.

SAN FRANCISCO, CAL.—The Standard Electric Company, of California, has completed its line of poles from Oakland, Cal., to Niles. It is said to be replacing the one-quarter inch transmission wire on the line to Stockton with the seven-eighths inch aluminum, which will be used on the long transmission line to San Francisco.

JOHNSTOWN, N. Y.—The Fulton County Gas & Electric Company, a new corporation, capital $1,500,000, has absorbed all the gas and electric companies in this county, namely, the Johnstown & Gloversville Gas Company, capital, $130,000; the Johnstown Electric Light & Power Company, capital, $100,000, and the Gloversville Electric Company, capital, $75,000.

LIMA, OHIO.—A company headed by Joseph B. Mayer, Herbert P. Bissell and H. St. C. Denny, of Buffalo, has purchased the plant of the Lima Electric Light & Power Company from the mortgagee, who recently bid it in, and it is the intention of the new owners to expend a considerable amount of money in rebuilding and putting the plant in first-class condition.

SAN FRANCISCO, CAL.—The General Electric Company recently closed contract with the owner of the electric light and power system in Walla Walla, Wash., for an electric plant to replace the single-phase, eight-mile transmission now in use. The new system will be a General Electric monocyclic at 6600 volts. A 300-kw monocyclic generator is included in the contract.

CHEYENNE, WYO.—The Cheyenne Light, Fuel & Power Company filed articles of incorporation. Capital stock, $600,000. Incorporators are: A. B. Browne, J. W. Lacey, William Sturgis, Charles M. Smith and Francis E. Warren, Cheyenne. This company is the Cheyenne Electric Light Company and the Cheyenne City Gas Company combined, and will make extensive improvements.

FAIRMOUNT, W. VA.—Mr. B. K. McMechan, of Wheeling, W. Va., has purchased all the stock of the Fairmount Electric Light & Power Company, and it is intended to enlarge the plant and improve its service in many ways. Mr. McMechan is said to be connected with the syndicate which is going to construct an electric railway in Fairmount, for which franchises have been granted by the local councils.

GOSHEN, IND.—This city has just completed, owns and will operate a thoroughly equipped electric light plant. The rates are lower than in most cities where municipal plants exist, ranging from 25 cents per lamp per month for residences to 45 cents for all-night business-room lights. The meter rate is 6 cents per 1000 watts. The city plant has a competitive plant owned by a private corporation, which offers the same rates.

SAN FRANCISCO, CAL.—The Standard Electric Company, of California, recently let contracts for the construction of two buildings, to be located near Mission San Jose. The main switching station for the 150-mile transmission lines from the main generating station in the Sierras will be located in one of these buildings. Three branch lines will extend from the switching station to San Jose, San Francisco and Oakland, respectively.

SAN FRANCISCO, CAL.—The San Francisco Gas & Electric Company recently made an offer to the Board of Supervisors to sell its poles and wires used in lighting the streets to the municipality for $50,000. The company offered to install a system of 6000 incandescent gas burners without any expense to the city. President Crockett, of the Gas Company, said that it would save the city an investment of $225,000 for 8300 electric light poles and a distributing system. An Eastern syndicate, also, made an offer to light the city, being represented by a local promoter.

SAN FRANCISCO, CAL.—Application has been made to the Board of Supervisors of Alameda County by the Yuba Electric Power Company to run lines from Contra Costa County through Alameda County, entering at Berkeley, for transmission of electricity for power and lighting. The company is incorporated for $1,000,000 and is headed by R. R. Colgate, of New York. Lines are built in Butte, Yuba, Nevada, Sutter, Placer and Sacramento counties, and applications for franchises to extend them into Yolo, Solano, Contra Costa and Alameda counties are now pending.

SAN FRANCISCO, CAL.—The Bay Counties Power Company, which has been incorporated by Eugene J. de Sabla, Jr., G. A. Grow, R. M. Hotaling, John Martin, William M. Pierson, Oscar Sutro and A. W. Linforth, with a capital stock of $5,000,000, for the purpose of purchasing and combining the Nevada County Power Company and the Yuba Electric Power Company and supplying Benicia, Woodland, Vallejo and Napa, Cal., with electric light and power, is reported to be an arrangement to facilitate making extensions and obtaining capital therefor. The new corporation will have about 20,000 horse-power available for electric power purposes, and will extend its circuits to a number of points in the counties surrounding San Francisco Bay.

## THE ELECTRIC RAILWAY.

LITTLE ROCK, ARK.—The strike of the motormen and conductors on the Little Rock Street Railway has been ended.

METAMORA, MICH.—A franchise has been granted to the Detroit & Lapeer Electric Railway by the council of this place.

SPRINGFIELD, MASS.—Springfield and Hartford capitalists will attempt to connect the two cities by a trolley line this summer.

SAN FRANCISCO, CAL.—The Market Street Railway Company, San Francisco, has commenced operating electric cars on its Montgomery and Tenth Street line.

LEICESTER, ENGLAND.—The Brush Electrical Engineer Company, Limited, is promoting a company, with a view of building an electric railway in Leicestershire, England.

GRAND RAPIDS, MICH.—The power house of the Grand Rapids Electric Light & Power Company was destroyed by fire recently, the building and machinery being a total loss.

OREGON CITY, ORE.—The Willamette Falls Railway Company is extending its West Side line in this city, a distance of 1½ miles up the Tualatin River, to reach a large body of timber land.

CONVERSE, IND.—The Town Council has granted a 50-year franchise to the Wabash capitalists, James Linn, C. E. Cowgill and M. S. Howe, for an interurban electric line from Rochester.

COLUMBUS, OHIO.—The Dayton & Northern Traction Company has been incorporated. Capital, $450,000. Incorporators: J. E. Lownes, J. E. Feight, H. C. Kietaber, E. Bimm, W. W. Gebhardt.

COLUMBUS, OHIO.—The Suburban Electric Railway Company, of Columbus, has been incorporated. Capital, $150,000. Incorporators: P. Jones, G. W. Dunn, E. Denmead, A. L. Thurman, A. W. Field.

MILWAUKEE, WIS.—On June 1 the Milwaukee Electric Railway & Light

Company advanced the wages of its employees 1 cent an hour. This will increase the company's pay roll about $1,800 a month.

CONESTOGA, N. Y.—The Conestoga Traction Company has elected these directors: William B. Givens, Samual R. Shipley, Robert Foulk, W. B. Kurtz, John D. Skiles, Eugene G. Smith and J. W. B. Bausman.

ELIZABETH, N. J.—It is reported that an attempt is being made by the North Jersey Traction Company and the stockholders of the Elizabeth City and Elizabeth & Plainfield Trolley Company to consolidate the three systems.

PITTSBURG, PA.—The West End Traction Company, of this city, is getting ready to build a bridge across Chartiers Creek, which will give the cars of the company an opportunity to get from Carnegie into the town of Heidelberg, Pa.

WEST SENECA, N. Y.—The extension of the Buffalo & Hamburg trolley line to the city line is about to be realized, as surveyors are at work. The line at present is but about three miles long, connecting West Seneca with Blasdell.

EL PASO, TEX.—The El Paso & Juarez Traction Company has been incorporated. Capital, $200,000. Incorporators: J. T. Terry, of New York City; A. Mills, of Washington; D. C. M. Weber, J. Magoffin, J. A. Happer, of El Paso.

GALLIPOLIS, OHIO.—The Gallipolis & Point Pleasant Electric Railway has suspended business and discharged all its employees. The road has not been earning working expenses recently, it is said, and heavy damage suits have been filed.

BRAZIL, IND.—The Brazil Electric Street Railway Company has been sold to John G. Bryson and J. N. Halsted, of this city, and Frank Edwards, of Indianapolis, for $33,750. The purchasers are agents for Stone & Webster, of Boston.

COLUMBUS, OHIO.—The Urbana, Mechanicsburg & Columbus Railway Company has made application for a 25-year franchise to the County Commissions of Franklin County. Gen. H. A. Axline, of Columbus, is at the head of this project.

MILTON, IND.—An electric railway is proposed to be built from this city to Economy, via Cambridge City and Hagerstown. The new line will intersect the road to be extended from Greenfield to Richmond, and thus connect Milton with Indianapolis.

ALBANY, N. Y.—The net income of the Albany Railway for the March 31 quarter in 1899 was $16,747, and of the Troy City $16,999, a total of $33,746, as compared with $33,817 shown by the United Traction Company for the 1900 March 31 quarter.

VALLEJO, CAL., has been requested to grant a street railway franchise to J. N. Patterson and others. A 50-year franchise is asked for, and the road is to be operated by electricity or other motive power. The U. S. Navy Yard is located near Vallejo.

ATLANTA, GA.—The Mercantile Trust & Deposit Company, of Baltimore, has secured $3,500,000 in bonds of the Atlantic Railway & Power Company and the Augusta Railway & Electric Company, the latter being for $1,000,000. Both are first mortgage bonds.

CLEVELAND, OHIO.—The Portage Lake Traction Company has been incorporated by David Glasscock, Carl H. Nau, Henry Lancefield and Charles L. Stocker to build an electric line from Cleveland to Ravenna and Kent, Portage County. The temporary capital stock is $10,000.

JOHNSTOWN, PA.—Five bids are in the hands of the Johnstown Passenger Railway Company for the construction of the road from Johnstown to Windber. The contract calls for the completion of the line by Nov. 15, and it is thought cars will be running on it by Thanksgiving Day.

EAST ST. LOUIS, ILL.—The Mississippi Valley Transit Company has awarded the contract for the erection of a power house and sheds to C. H. Way, of East St. Louis, for the sum of $14,000. The building will be erected at French village, and will be ready for occupancy within 30 days.

TOLEDO, OHIO.—The Toledo, Fremont & Norwalk Electric Railway Company has completed arrangements with the Toledo Traction Company for the entrance into Toledo over the East Broadway division of the Traction Company's line. Construction work on the road is progressing rapidly.

TROY, N. Y.—The United Traction Company has filed its report with the Railroad Commissioners for the quarter ended March 31, as follows: Gross earnings, $299,047; operating expenses, $207,578; net earnings, $91,469; other income, $1,002; fixed charges, $58,654; net income, $33,817.

NEW HAVEN, CONN.—The completion of the largest deal in electric power and lighting in New England is announced. It is the complete absorption of the Connecticut Lighting & Power Company by the United Gas Improvement Company, of New York and Philadelphia, at a cost of $15,000,000.

KOKOMO, IND.—The County Commissioners have granted a franchise for an electric railway line to G. W. Landen, of this city, and Carey E. Cowgill and James Lynn, of Wabash, trustees for the Kokomo, Wabash & Northern Electric Railway Company. This is a revival of the Kokomo & Wabash project.

EAST ST. LOUIS, ILL.—The Drummond faction of the Winstanley Park Village Board in East St. Louis has passed an ordinance annulling the franchise of the Day and Suburban Electric lines. It is stated that as soon as the ordinance can be published the village marshal will be ordered to stop the cars and tear up the tracks.

YOUNGSTOWN, OHIO.—The Mahoning Valley Electric Railway Company has temporarily increased the capacity of its power house by the addition of a 400-kw Walker generator belted to a 600-hp Dick & Church engine. The company is making plans for an extensive central station, which will furnish power for the entire system centering in Youngstown.

ALBANY, N. Y.—The Syracuse & South Bay Railroad Company has been incorporated to build an electric road 12 miles long, from Syracuse to South Bay road, on the southern shore of Oneida Lake. The capital is $120,000, and the directors are George D. Chapman, James E. Ratchford, Hiram W. Plumb, of Syracuse; George R. Allen, of Cicero, and others.

TOLEDO, OHIO.—The Toledo & Monroe Construction Company, Limited, has been incorporated in Michigan to construct electric railways in Michigan and adjoining States. The capital stock is $5,000, and the holders, C. A. Black, E. U. Fowler, A. E. White and J. U. Mulkey. The company is doing the construction work for the Toledo & Monroe Electric Railway.

SPANISH RAILWAYS.—Spain is rapidly recovering from the effects of the war and has apparently decided to increase its electric street railway systems very considerably, concessions having been given for the following: Cadiz to Fernando, Corunna to Burgos de Santiago, San Sebastian to Tolosa and Arriondas to Coradonga. Several other roads are contemplated.

EAST ST. LOUIS, ILL.—The St. Louis & Belleville Traction Company, which owns the two lines operating between East St. Louis and Belleville, has disposed of $250,000 worth of the bonds of the company at a handsome premium, which indicates that both lines are money-makers. The roads were built about two years ago, and it is claimed that from the day of the opening each paid expenses.

LOCK HAVEN, PA.—The Lock Haven Traction Railway, which was recently sold at receiver's sale, has passed into temporary control of the Susquehanna Traction Company. The president is William B. Given; secretary, W. H. Daron; treasurer, H. P. Rhodes, all of Columbia. They, with C. A. Bragg and W. D. Marks, of Philadelphia, and General Manager Frank Andes, of this city, are the directors.

BLUFFTON, IND.—The Indiana & Ohio Electric Railway Company, to build a line between this place and Muncie, has decided to establish a through electric freight system, the only one in Indiana. Four specially built motor cars have been ordered. Each will draw 13 loaded freight cars of any type. The managers have entered into an agreement with the Union Traction Company to enter Muncie on the Traction Company's line.

PITTSBURG, PA.—Work has been started on Grandview Avenue, Mt. Washington, this city, laying the track for the new Sycamore Street Railway. Booth & Flinn, of this city, are the contractors, and they expect to have the road in operation by next fall. The line will run from the Union Station along Wood and Water streets, across the Smithfield Street Bridge to the south side. Up Sycamore Street it will run by means of a cog railroad.

ALBANY, N. Y.—The executive committee of the United Traction Company has decided that the pay of the conductors and motormen on the Albany division hereafter shall be the same as on the Troy division, 20 cents an hour for men on regular runs and 18½ cents an hour for those who have extra cars. This change made by the executive committee makes the wage rate uniform, all its operators on regular cars from this date receiving 20 cents, and all others 18½ cents an hour.

AKRON, OHIO.—The Northern Ohio Traction Company is making extensive improvements to its lines. The road to Cleveland is being double tracked a greater portion of the way, and much grading and cutting is being done. Work on the new power house at Akron is progressing rapidly, and it will be in operation within 60 days. The company is receiving 15 Jackson & Sharp open cars, which are to be placed on the city lines; they are equipped with 50-hp Westinghouse motors and Brill trucks.

CINCINNATI, OHIO.—President John Kilgour, of the Cincinnati Street Railway Company, has been consulting employees of the road regarding the betterment of their condition. It is said he has discussed the proposition of increasing wages. The men proposed a graduated scale, fixing the minimum wage rate at 16⅔ cents an hour, the present rate, with a graduated increase for older men. Kilgour has not decided what course to pursue. Mr. Kilgour admitted that a scheme of dividing part of the road's profits among the employees had been considered.

SPRINGFIELD, OHIO.—The National Traction Company, with headquarters at Phoneton, Miami County, has been given a 25-year franchise through Clarke County. A similar franchise has been secured through Miami County. The road is to run from Columbus, passing through London and Springfield to the western State line, where it will connect with a line to Indianapolis. One power house will probably be located at London and another in the western part of Clark County. The officers of the company are: J. Q. A. Coover, president, and N. A. Albaugh, secretary.

COLUMBUS, OHIO.—The Columbus, London & Springfield Electric Railway Company has made application for a 25-year franchise to the commissioners of Franklin County. The officers of the company are: C. E. Wentworth, president; John G. Webb, vice-president; J. M. Good, second vice-president; Emmett Thompkins, secretary; H. A. Fisher, general manager; directors, C. E. Wentworth, Cambridge, Mass.; A. D. Richards, Worcester, Mass.; John G. Webb, John M. Good and Fletcher S. Panfield, Springfield, Ohio; Hart A. Fisher and George T. Sparr, Columbus, Ohio.

PITTSBURG, PA.—President C. L. Magee, of the Consolidated Traction Company, has called a meeting of the stockholders of that company for June 20, when the question of leasing the company's lines to the Union Traction Company will come up for consideration. It will be remembered that at the meeting in April for the same purpose opposition developed at the last moment, which prevented the consummation of the company's plans, but it is expected that this opposing movement has been brought around, and no further hitch in the general consolidation of all the traction lines in the city is anticipated.

BOSTON, MASS.—The South Shore & Boston Street Railway has passed into the control of the Massachusetts Electric Companies, George A. Fernald & Company having sold to them 6000 shares ($600,000) out of a capital stock of 6900 shares ($690,000). The South Shore & Boston Street Railway is the result of the consolidation of the Rockland & Abington Street Railway, Bridgewater, Whitman & Rockland Street Railway, Hanover Street Railway, Hingham Street Railway and the Braintree & Weymouth Street Railway, brought about last year by George A. Fernald & Co., and Pepper & Register, of Philadelphia.

BOSTON, MASS.—At a meeting of the directors of the New England Street Railway Company the resignations of the board of directors were accepted. The vacancies were filled by the election, from the list of stockholders, of others who are friendly to the interests of George A. Fernald & Company, who have been negotiating for the control of the Winchester Avenue Railroad Company, of New Haven, through the medium of the New England Street Railway Company,

which owns a controlling interest. George A. W. Dodge was elected president of the New England Street Railway Company, and Col. John J. Whipple, vice-president.

FORT WORTH, TEX.—The work of constructing the longest electric railway in Texas will soon commence, a company having been organized to build a line from Dallas to Fort Worth, a distance of 32 miles, and thence to Cleburne, a total distance of about 60 miles. The company's capital stock is $1,000,000, ten per cent of which has already been paid in. The incorporators are George T. Bishop, J. B. Coffinberry, George F. McKay, M. G. Watterson, all of Cleveland, Ohio, and other Ohio and Texas capitalists. The road will do both a freight and passenger business. This company is negotiating for the purchase of the Fort Worth & City Consolidated Street Railway system in Fort Worth, and if it is acquired it will be operated in connection with the main line between Dallas and Cleburne.

PITTSBURG, PA.—One of the largest street railway deals that has ever been made in Western Pennsylvania is now rapidly being completed in Fayette, Westmoreland and Allegheny counties, and it is expected that within a year there will be a system of electric railroads running from the city of Pittsburg to Fairchance, a distance of 80 miles. The nucleus of this proposed system is the Mt. Pleasant, Connellsville & Uniontown Street Railway Company. This company has recently purchased the line of the Connellsville, New Haven & Leisenring Street Railway Company, and the line of the Uniontown Street Railway Company. These tracks will form a link between Connellsville and Graham's Crossing, near Dunbar, and between Lemont and Fairchance, thus completing already a long stretch of the system. At Valley the company has purchased the Sherrick Farm for the purpose of erecting a large power station and a general office building. The company has just completed a deal by which it acquired a line from Versailles to McKeesport, where the company's line will connect with the United Traction Company of Pittsburg, and thus gain an entrance into this city. Eventually the line is expected to run through from Pittsburg through Braddock, McKeesport, West Newton, Alverton, Mt. Pleasant, Scottdale, Connellsville, New Haven and Dunbar with many coke towns and villages.

## THE AUTOMOBILE.

THE ST. LOUIS AUTOMOBILE & SUPPLY COMPANY, the first of its kind in St. Louis, has been incorporated with a capital stock of $10,000. The object of the company is to manufacture automobiles and furnish supplies. Peter A. O'Neil, F. W. Nolker, Valle Reyburn, John C. Kennedy, B. C. Keeler, F. E. Busch and A. T. Dyke are the incorporators.

AUTOMOBILE SHOW.—Arrangements are being made to hold the first annual automobile show of the Automobile Club of America at Madison Square Garden, New York, from Nov. 3 to Nov. 10 next. There will a track, where the machines can be tested, and prizes will be awarded in most of the classes. It is stated that most of the desirable spaces in the Garden have already been disposed of.

THE WOODS MOTOR VEHICLE COMPANY, of Buffalo, has been incorporated, with headquarters in Buffalo, N Y., to manufacture motor vehicles. Capital, $300,000. Incorporators: J. J. McWilliams, R. K. Root, C. R. Huntley, F. S. McGraw, H. H. Hewett, all of Buffalo; F. Nichols, of Toronto, Canada; De Lancey Rankins, attorney, Niagara Falls; Bissell, Cary & Cooke, attorneys, Buffalo.

## NEW INDUSTRIAL COMPANIES.

THE ELECTRIMOTE COMPANY, of Chicago, has been chartered to manufacture and deal in electrical devices. Capital, $2,400. Incorporators: W. C. Jones, H. W. Addington, C. B. Camp, all of Chicago.

THE INDIAN TERRITORY COMPANY, of New York, Philadelphia and Texas, has been chartered to build railroads, telegraph and telephone systems and to do a general mining and manufacturing business. Capital stock, $5,000,000.

THE STOREY MOTOR & MACHINE COMPANY, of Jersey City, N. J., capital $3,500,000, has been chartered to manufacture electric and pneumatic machinery. The incorporators are R. A. Jenks, James H. Young, Rudolph Neuman, all of Jersey City.

THE FRALEY ELECTRO-THERAPEUTIC COMPANY, of Atlantic City, N. J., has been incorporated to deal in electrical appliances. Capital, $100,000. Incorporators: H. B. Cook, E. A. Hill, A. A. Redfield, all of Atlantic City; G. B. Fraley, attorney, Atlantic City.

THE RICHMOND ELECTRIC COMPANY, of Manchester, Va., has been chartered to manufacture electrical machinery, etc. Capital, $100,000. Incorporators: E. J. Willis, G. C. Scott, H. E. Basherville, F. W. Scott, W. B. Tennant, all of Richmond; J. Hale, of Newburyport, Mass.

THE ELECTRIC TRIPARTITE STEEL POLE COMPANY, of Newark, N. J., has been incorporated, with a capital of $100,000, to manufacture posts for electric railways. Washington E. Page, of Franklin; Samuel C. Martin, and George V. A. Conger, of Belleville, are the incorporators.

THE ELECTROMAGNETIC BRAKE COMPANY, of Union, N. J., has been incorporated to manufacture an electric brake for electric elevators, etc. Capital, $50,000. Incorporators: W. White, L. Fiehm, H. C. Steinhoff, L. A. Menegaux, J. S. Darling, T. R. Rabone, H. M. Earle, attorney, New York.

## LEGAL.

FARES ON DETAINED CARS.—A case of importance to traction companies was tried in the Pittsburg local courts last week, in which a decision was rendered by Judge R. S. Frazer. The plaintiff, a man named Hickman, sued the Pittsburg & Birmingham Traction Company for being arrested because he had refused to pay his fare when the car had been stopped, owing to an accident. The judge held that under these circumstances the Traction Company had no right to detain the passenger, and the jury gave the plaintiff a verdict for $550.

## PERSONAL.

D. H. DARLING, secretary of the United States Battery Company, New York City, was in Cleveland recently, looking up the motor vehicle trade.

E. W. RICE, JR., third vice-president and head of the engineering department of the General Electric Company, sailed for Europe on June 6. He will visit the Paris Exposition.

Y. SASAKI, of the Nankai Railway Company, Osaki, Japan; K. Nishino, general traffic manager of the Sanyo Railway Company, and P. Ikeda, of Kioto, Japan, inspected the Brooklyn Rapid Transit Company's system on June 7. These gentlemen have been for the past few months on a tour of inspection of the various railway systems of the world, and in that time have visited Italy, Germany, France and England.

## Trade Notes.

MR. V. C. GRACE has severed his connection with the Chicago General Fixture Company, and is now singing the praises of Robert L. McOuat, of Indianapolis, Ind.

THE BURT MANUFACTURING COMPANY, of Akron, Ohio, has received an order for their Cross oil filters to equip a large copper works at Saltillo, Mexico.

THE ELECTRIC APPLIANCE COMPANY, Chicago, is out with neat circulars, showing its No. 12 and No 14 Bell type telephones in the different styles for series, exchange and bridging work.

THE E. A. KINSEY COMPANY, Cincinnati, Ohio, reports that its electric railway material department is busier than at any former period this year. The company reports also a good demand for power machinery.

BURNHAM-GETHINS COMPANY.—Mr. Fred A. Fernald has filed his report as receiver of the Burnham-Gethins Company, which report will come up for acceptance June 19, in Boston, in the Equity Session of the Superior Court.

SCHMIDT & BRUCKNER ELECTRIC COMPANY.—Mr. Lambert Schmidt has been appointed receiver of the Schmidt & Bruckner Electric Company in proceedings for the dissolution of that firm, and has sole authority to wind up the affairs.

THE ADAMS & BAGNALL COMPANY, Cleveland, reports that it is now enjoying the heaviest business in its history. During the month of May, 2600 lamps were turned out, and at present the company is fully that number behind on orders.

"STELLITE."—The British Electric Works Company, Limited, 11 Charing Cross Road, London, W. C., England, has issued a catalogue illustrating some of its "Stellite" electrical accessories, consisting of lamp sockets, ceiling rosettes, switches, wire connectors, etc.

THE JOHN MARTIN COMPANY, representing the Stanley Electric Manufacturing Company on the Pacific Coast, will equip the Ward Mine Company with electric motors for its works. The John Martin Company on June 1 removed to 31-33 New Montgomery Street, San Francisco.

MR. O. M. CARMAN, who has been representing the Commercial Supply Company, of St. Louis, Mo., has associated himself with the well-known firm of Robert L. McOuat, successor to Varney & McOuat, Indianapolis, Ind. Mr. Carman is a great favorite among the electrical fraternity, and he will be an acquisition to Indiana.

RAW HIDE GEARS.—The New Process Raw Hide Company, Syracuse, N. Y., has issued a new pamphlet descriptive of its patent noiseless gears, the pamphlet being enclosed in a case for the pocket. The first pages give a description of the New Process raw hide, following which are lists of the different sizes of gears, with prices.

THE AKRON ELECTRICAL MANUFACTURING COMPANY, of Akron, Ohio, recently closed a contract with the Ward-Mackey Company, of Pittsburg, to equip its large cracker factories with a complete lighting and power plant. When completed this factory will be one of the best electrically equipped plants of the kind in Pennsylvania.

MR. NORMAN MARSHALL has resigned his position as general manager of the Anchor Electric Company. The rapidly growing business of the Marshall-Sanders Company, manufacturers of sockets, switches, cut-outs and other specialties of Mr. Marshall's invention, has necessitated his giving his entire time to the business of this company.

THE LAWTON-BEATTIE COMPANY, Cincinnati, Ohio, is figuring on the installation of a light plant for the annual picnic of the National Cash Register Company, which is to be held at Dayton this month and will last four days, and which is expected to require a 450-kw generating machine. A grove near Dayton has been secured for the picnic, and electric lighting will be a feature.

THE GENERAL EQUIPMENT COMPANY, of Camden, N. J., reports that it has never been busier than at present. Among the number of big orders recently received is one from the Electric Storage Battery Company for 36 circuit breakers of all sizes. Mr. C. J. Harrington, manager of sales department, is now on a trip through New England and reports that the outlook for business in that territory is exceedingly good.

THE GUARANTEE ELECTRIC COMPANY, 133 South Clinton Street, Chicago, reports that it just purchased one thousand 110-volt enclosed arc lamps from the Siemens-Halske Electric Company, and will continue to supply its customers with this type of lamp. Seven cars of material were purchased from this company just prior to its consolidation with the General Electric Company, the lot including 30 dynamos and the arc lamps above referred to.

MR. CHARLES W. COBB, sales manager of the Chicago Mica Company, has been in the East for the past two weeks on a business trip. One of the objects

of his visit to the East is the establishment of a New York branch office. Mr. Cobb reports that his company's product has met with so favorable a reception in New England, for which territory C. S. Knowles, of Boston, is its agent, that the company has decided to push its product more energetically in the New York territory.

G. I. BINDER.—The publications of the General Incandescent Arc Light Company have become so numerous and interesting that electrical men everywhere will be glad to know that a very neat binder has been brought out which will protect them, and make reference to any of the G. I. products and prices easy. This binder, handsomely finished in black and gold, is mailed to those interested on request, and contractors, supply houses, etc., etc., placed on the mailing list for all publications.

THE AMERICAN ELECTRIC FUSE COMPANY, 345 South Canal Street, Chicago, Ill., secured from Mr. F. W. Maxstadt on May 4, 1900, an assignment of his patent rights on fuses and fuse blocks under the original Maxstadt patents. The company named states that it is now the only manufacturer having the right to make the genuine Maxstadt patent fuses and fuse blocks. It has recently doubled its capacity by adding another floor to the factory space, and is manufacturing fuses in large quantities.

CROSBY STEAM APPLIANCES.—The Crosby Steam Gage & Valve Company has issued a handsome, cloth-bound volume of 186 large octavo pages descriptive of its various manufactures, consisting of valves, lubricators, steam whistles, water columns, recorders for pressure, draft, etc., engine-room fittings, etc., and last, but not least, the Crosby steam-engine indicator. The section of the book devoted to the latter and its fittings includes 36 pages, the whole forming an excellent treatise on the steam-engine indicator.

FEDERAL SALT.—The Federal Battery Company, of New York, announces that it has made arrangements with the Frank S. DeRonde Company, of New York and 48 North Fourth Street, Philadelphia, to carry Federal Salt and Federalite in quantity, as a convenience to the wholesale trade in the following territory: Delaware, Maryland, Eastern Pennsylvania, lower New Jersey and District of Columbia. They are now prepared to supply the wholesale trade in this territory at exactly the same rates as the Federal Battery Company.

THE KEYSTONE ELECTRIC COMPANY has just opened its establishment at 135 South Tenth Street, Philadelphia. Mr. F. Geiger, who is general manager, has had 17 years' experience in electrical work, and Mr. William L. Turner, manager of the sales department, has been connected for 12 years with leading electrical concerns. The Keystone Company will manufacture many electrical lines, but its specialty is electro-therapeutic apparatus, including static machines, Roentgen-ray outfits, etc. Telephones of all kinds will also be manufactured.

THE CHICAGO RHEOSTAT COMPANY is sending out under one cover two bulletins, descriptive of its combined under and overload starters, its motor-starting rheostats, motor-speed regulators, dynamo-field rheostats, etc., etc.—in short, a complete catalogue of all kinds of electrical controlling machinery. The last page is entirely taken up by a half-tone of the company's new factory in New York City, a block extending from 397 to 407 East Thirty-third Street. Here are carried in stock all standard parts, ready for quick assembling, as well as completed apparatus.

LITOFUGE.—The Litofuge Manufacturing Company, 1710 Market Street, Philadelphia, has issued the seventh edition of its pamphlet on the application of "Litofuge" to the cleansing and preservation of steam boilers. This is a purely vegetable boiler compound for the removal of scale and the prevention of scale formation and galvanic action. The pamphlet contains a number of letters of a character which few manufacturers are able to boast. Among these are favorable official reports made by officers of the United States, French, Belgian, Italian and Austrian navies.

A MAMMOTH ELECTRICAL SUPPLY CATALOGUE.—The Western Electrical Supply Company, of St. Louis, has issued what is probably the largest catalogue of electrical supplies ever printed, containing as it does no less than 1054 large octavo pages (6¾ ins. x 10¼ ins.). Every branch of the electrical industry appears to be represented, the items ranging from alternating-current generators and motors to house goods. Several thousand engravings illustrate the various types of apparatus. An excellent quality of paper is used and the volume is substantially bound in buckram.

THE GARL ELECTRIC COMPANY, Akron, Ohio, is meeting with pronounced success in introducing its street railway telephone system. Among recent contracts it is preparing the complete equipment of the Southern Ohio Traction Company, including 28 cars and a number of box stations; the equipment of the Xenia Traction Company, the Cincinnati, Lawrenceburg & Aurora Electric Railway, the Dayton, Springfield & Urbana Electric Railway and an additional equipment for the Dayton & Western Electric Railway. The Garl Company is designing a special new switchboard for street railway work.

THE FALCON ELECTRIC MANUFACTURING COMPANY, 432 East Seventy-first Street, New York, has secured the contract for the switchboard at Bloomingdale Bros., Fifty-ninth Street and Third Avenue, New York. This switchboard is 12 ft. long and 15 ft. high, having an upper and a lower section. The lower section contains all the apparatus for the seven generators, switches, circuit breakers, switches, field rheostats, amperemeters, and the upper section contains all the feeder switches. The entire board controls an output of 500 kilowatts, and will be one of the largest boards installed in an isolated plant.

VARNEY ELECTRICAL SUPPLY COMPANY.—Mr. G. E. Varney, of Indianapolis, Ind., has recently disposed of his interest in the Varney & McOuat Electrical Supply Company, and has organized a new company under the corporate name of the Varney Electrical Supply Co. This new company is located at 235 South Meridian Street, in a building consisting of three floors. It also has an attractive store front, where all the latest, up-to-date electrical novelties handled by this company will be displayed. It will also run a repair department, and be in shape to make repairs on all kinds of electrical and street railway apparatus on short notice.

THIN LEAD TUBING.—The Ellwood Ivins Tube Works, Oak Lane Station, Philadelphia, are making lead tubing with extremely thin walls, and in sizes from 2 ins. in diameter down as small as 1-64 in. In covering insulated wire, lead covering has heretofore been necessarily very thick, owing to the process of making it. This mill has, it seems, succeeded in making it very thin and, of course, proportionally much lighter. As the lead does not wear out, but merely serves as a protector, these thin tubes into which wires can be placed seem to be a good thing. They do not make the wires, confining their works to seamless tubing only, and in all metals.

THE KENT STANDARD BATTERY FAN, which for two years was manufactured by the Kent Electric Manufacturing Company, is now made with improvements by Kendrick & Davis, Lebanon, N. H. This year a switch is placed on the motor, in an out-of-the-way place. In the place of the flat-ribbon brushes, woven wire, end-thrust brushes are substituted. Several other new features have been added, which add greatly to the general working and appearance of the fan. It is of the single bearing, of the type with both ends brass-bushed, and its drum armature avoids rattling. It is finished in black Japan and its fan and guard, together with its trimmings, are nickel-plated.

BUFFALO BILL IN ALBANY.—The Stephenson Manufacturing Company, of Albany, N. Y., was made aware of the arrival of the Buffalo Bill Show in Albany by an early visit from the chief electrician. After careful fishing through an inside pocket for an old Stephenson circular, he stated that some time ago he ran across the Stephenson "bar" belt dressing in New Jersey, and as it was without exception the best thing of the kind he had ever found, he had carried the circular with him, anticipating the pleasure of buying the dressing at headquarters when he reached Albany. Referring to the advantages of this dressing, he said that about all he had to do was "to threaten a belt with an application when it would stop slipping at once."

MECHANICAL DRAFT.—The rapid strides which mechanical draft is making as a substitute for chimney draft are well exemplified by the statement recently made by the B. F. Sturtevant Company, of Boston—the pioneers in the introduction of the fan in the place of a chimney—to the effect that their sales of apparatus for stationary boiler plants were last year over three times those for the year before, and that they now amount to nearly 1000 horse-power per day, about equally divided upon stationary and marine plants. It is also interesting to note that in a number of the technical schools of the country experimental mechanical draft apparatus has been installed, principally for the purpose of instruction, and that numerous graduating theses are concerned with the investigation of this subject.

ENLARGING A CLEVELAND STATION.—The Cleveland Electric Illuminating Company, Cleveland, Ohio, has commenced work on an addition to its power house. The new equipment will consist of two McIntosh & Seymour engines of 1275 horse-power each, 24 x 48, with 48-in. stroke, 100 r. p. m., one of them a cross-compound and the other a tandem-compound. One of the engines is direct-connected to an 800-kw, direct-current, 250-volt generator, and the other to a large three-phase, 60-cycle alternator, giving 2300 volts. Both generators are of the General Electric Company's make. The additional boiler house equipment will consist of one 800-hp Climax boiler, equipped with American stokers. The total boiler capacity will be 5300 horse-power when the new addition is completed.

GENERAL ELECTRIC LITERATURE.—Standard Fuses is the subject of a 36-page pamphlet recently brought out by the General Electric Company. The various styles of fuses are illustrated and accompanying tables give their commercial rating. The company has also issued a pamphlet on repair parts of Type K Series Parallel Controllers. Every part of the controllers is illustrated separately and in combination with the other parts, showing the controller complete. Each part is numbered and dimensions given, and it will be an easy matter to order any particular piece by referring to its catalogue number. Leaflets have also been issued by the General Electric Company on Commutators for Thomson arc machines, and Alternating-current Fan motors. All of this new literature has been gotten up in the usual artistic style of the company.

THE CONSOLIDATED RAILWAY ELECTRIC LIGHTING & EQUIPMENT COMPANY, New York, will exhibit at the annual convention of the Master Car Builders' and American Railway Master Mechanics' Association, at Saratoga Springs, N. Y., during the week commencing June 18, a private car equipped with its system of electric train lighting from the car axle. The officers of the company will have their headquarters in Cottage D, Grand Union Hotel, in which also will be exhibited a model of the mechanism of the axle light equipment for steam railroad cars. Our readers will recall a description of this system, which appeared in these columns several months ago, since which time, however, many further improvements have been introduced. The system consists in providing each car with a generator geared to the axle, and a storage battery. A carefully worked out series of devices provide for a constant voltage on the working circuit, no matter what may be the speed of the car. The storage battery is charged at the higher speeds, and feeds the circuit at low speeds, or when the car is not in motion.

THE GREGORY ELECTRIC COMPANY, of Chicago, reports business exceptionally good for this time of the year, its works being fully as busy as during the great rush times of last fall. Among recent shipments it sent a 500-kw G. E. electric railway generator to the Syracuse & Suburban Railway Company, of Syracuse, N. Y.; one 150-kw Westinghouse alternator to the Chesapeake Beach Railway Company, of Chesapeake Beach, Md., and one to the Ashland Electric Light & Street Railway Company, of Ashland, Wis.; a 45-kw Westinghouse alternator to the Biwabic Electric Company, of Biwabic, Minn., and another to the Tower Electric Company, of Tower, Minn.; a 50-light T.-H. arc machine, with extra armature, to the Salida Electric Company, of Salida, Colo.; a 60-kw Westinghouse alternator to the Indiana Street Railway Company, of South Bend, Ind.; a 100-hp Crocker-Wheeler 500-volt generator to the Wichita Gas & Electric Company, of Wichita, Kan.; a 125-hp, 500-volt Commercial railway generator to the Fort Madison Electric Company, Fort Madison, Ia.; a 1500-light Slattery alternator to the Taylor Electric Light & Power Company, of Taylor, Tex.; a 1200-light National alternator to the Minoqua Electric Light Company, of Minoqua, Wis.; a 1200-light T.-H. alternator to the Highland Park Electric Company, of Highland Park, Ill.; a 125-light Excelsior arc machine to the Harvey Water & Light Company, of Harvey, Ill.; a 2000-light T.-H. alternator to the Swift Electric Company, of Saginaw, Mich., besides a large number of smaller motors and dynamos.

# Record of Electrical Patents.

UNITED STATES PATENTS, ISSUED JUNE 5, 1900.

[Conducted by William A. Rosenbaum, Patent Attorney, Times Bldg., N. Y.]

650,836. TELEGRAPH SOUNDER; F. Hatmaker, Pittston, Pa. App. filed July 31, 1899. An adjustable tension device for the lever consists of a bowed spring connected to the lever and to the lever support and provided with means for varying the length of the arm of the spring.

650,846. APPARATUS FOR ELECTROLYTIC REDUCTION OF ORES; F. H. Long, Chicago, Ill. App. filed June 22, 1898.

650,860. ELECTRICAL CONNECTOR AND METHOD OF MAKING THE SAME; T. J. McTighe, New York, N. Y. App. filed March 30, 1900. A method of splicing electrical cables, consisting in enclosing their ends in a ductile metal sleeve and then swaging down the sleeve into intimate contact with the end and causing the metal of the sleeve to fill the external crevices of the cable.

650,861. ELECTRICAL CONNECTOR AND METHOD OF MAKING THE SAME; T. J. McTighe, New York, N. Y. App. filed March 30, 1900. A method of uniting a conductor to a terminal, which consists in inserting one into the other and cold welding them together by pressure.

650,862. ELECTRICAL CONNECTOR AND METHOD OF MAKING THE SAME; T. J. McTighe, New York, N. Y. App. filed Feb. 27, 1900. A method of splicing electrical conductors, which consists in enclosing the ends of the conductors in a ductile metal sleeve and subjecting the same to sufficient lateral pressure to cold weld the contacting surfaces together.

650,872. ELECTRIC ARC LAMP; W. L. Silvey, Dayton, Ohio. App. filed Nov. 27, 1899. This is a focusing or headlight lamp, the invention consisting in various details.

650,878. TROLLEY; F. B. Torrey, Bridgeport, Conn. App. filed Aug. 16, 1899. Friction between the ends of the forks and the ends of the hub is overcome by washers which carry lubricating material.

650,885. ELECTRIC STORAGE BATTERY AND CONDUCTING PLATE THEREFOR; S. L. Wiegand, Philadelphia, Pa. App. filed June 5, 1897. The plate is in the form of a tray and is provided with curled edges, preventing the escape of a liquid insulating material contained in the tray.

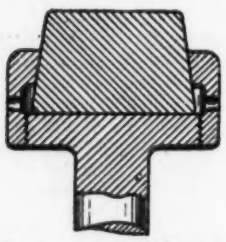
650,886. SECONDARY BATTERY; S. L. Wiegand, Philadelphia, Pa. App. filed Nov. 28, 1899. A modification of the preceding.

650,888. ELECTRIC ARC LAMP; J. J. Wood, Fort Wayne, Ind. App. filed Oct. 10, 1899. Details.

650,904. TROLLEY; G. H. McGwire, Denver, Colo. App. filed Oct. 20, 1899. An automatic device for preventing the rise of the trolley pole when the wheel leaves the wire.

650,905. ELECTRICAL GLOW LIGHT WITH SECOND-CLASS CONDUCTORS; Carl Ochs, Berlin, Germany. App. filed Sept. 16, 1899. Means are provided for starting and operating an electrolytic lamp. A solenoid breaks the circuit of the heating device when the electrolytic conductor is brought to incandescence.

650,915. RELAY FOR TELEPHONE LINES; C. E. Scribner and F. R. McBerty, of Chicago, Ill. App. filed Feb. 14, 1898. Consists in details of structure producing simplicity and cheapness of cost of manufacture.



650,953.—Carbon Contact Piece.

650,928. SUSPENSION CLAMP FOR ELECTRIC CONDUCTORS; I. J. Crowley, Chicago, Ill. App. filed July 8, 1899. A bracket to be attached to a pole is provided with an out-rigger, having a seat for the cable, and a strap which passes around the outrigger and the cable.

651,014.—Space Telegraphy.

650,929. CONTACT BOX FOR ELECTRIC RAILWAY; A. Diatto, Turin, Italy. App. filed July 30, 1898. The chamber containing the contacts is made moisture-tight by means of a mercury seal.

650,952. ELECTRIC RAILWAY SYSTEM: W. Robinson, Boston, Mass. App. filed Feb. 23, 1898. The automatic switches which throw the current on to the sections of the working conductor, at the same time close shunt circuits around their magnets, which carry a portion of the feeding current.

650,953. CARBON CONTACT PIECE; G. A. Schoeller, Mulheim-on-the-Ruhr, Germany. App. filed Nov. 27, 1899. The contact piece is of the kind used in electric switches, and is in the form of a truncated cone secured upon its carrier by a correspondingly recessed retaining nut having a threaded connection with the carrier.

650,972. ELECTRIC CONDUCTORS; L. Hackethal, Hanover, Germany. App. filed Dec. 20, 1898. The insulation of the conductor is of fibrous material impregnated with a mixture of red lead and oil.

650,973. ELECTRICAL SYSTEM FOR WATER-TIGHT DOORS; G. H. Hill, East Orange, N. J. App. filed Dec. 23, 1899. Electrical devices are provided at the door and at a distance from the door, whereby it may be closed at will, and arrangements are made for taking the control away from the distant point by any person at the door.

650,987. ELECTRIC CONDUCTOR; O. P. Ostergren, New York, N. Y. App. filed June 27, 1899. In order to lower the resistance of an electric conductor, it is proposed to keep it cool by running it in proximity to a conduit containing liquid air.

650,995. ELECTRIC PUNKA MOTOR; H. Spuhl, St. Gall, Switzerland. App. filed March 8, 1900. The vibratory motion given to an armature by the opening and closing of a magnet is utilized to rotate a pulley, first in one direction and then in the other. The pulley winds and unwinds a cord which is attached to the fans.

650,997. ELECTRIC RAILWAY SWITCHES; J. M. Taylor, Omaha, Neb. App. filed Aug. 29, 1899. A truck running in a conduit supports the car above ground, and without the aid of rails on the surface of the ground.

651,013. ELECTRIC TELEGRAPHY; I. Kitsee, Philadelphia, Pa. App. filed May 20, 1896. The invention consists in the conversion of the glow-rays of the vacuum tube generated therein, with the aid of an interrupted or alternating current, into sound or record.

651,014. SPACE TELEGRAPHY; I. Kitsee and C. E. Wilson, Philadelphia, Pa. App. filed May 26, 1899. This is an attachment for the receiving device whereby the direction whence the message comes can be ascertained. The receiver consists of a sphere partially surrounded by a shield. Receiving instruments are connected with both the sphere and shield. By rotating the shield around the sphere, and watching the instruments, the direction whence the message comes can be ascertained.

651,033. MANUFACTURE OF ELECTRICAL CONDUCTORS; G. W. Gesner, New York, N. Y. App. filed Dec. 19, 1899. (See Current News and Notes.)

651,055. TROLLEY; W. B. Potter, Schenectady, N. Y. App. filed June 11, 1898. A trolley head carrying three contact devices triangularly mounted on the end of the pole, said devices adapted to engage separate trolley wires and the head being adjustable so as to maintain a contact at each of the devices.

651,063. INSULATED CONTACT OR TERMINAL FOR ELECTRIC CIRCUIT; C. C. Badeau, Schenectady, N. Y. App. filed March 30, 1900. A thin bushing passing through the face of a switchboard is insulated by a surrounding fabric impregnated with oil; the conductor passes through this bushing.

651,067. ELECTRIC GAS LIGHTING APPARATUS; W. E. Cram, Boston, Mass. App. filed May 5, 1899. Structural details.

651,112. ELECTRIC CONTROLLER FOR RAILWAY SWITCHES; H. A. Gorn, New York, N. Y. App. filed Oct. 19, 1899. Railway switches are controlled from a distant point in such a manner that the switch can be operated in connection with a visual indicator placed at a convenient point for observance by the operator, so that he is informed of the action of the switch.

651,140. TROLLEY REPLACER; J. Goldsworthy, Indianapolis, Ind. App. filed Dec. 29, 1899. A device carried at the end of the pole and arranged to be thrown into operative position when the rope is hauled down.

651,143. COUPLING FOR CABLE ENDS; J. C. Kurtz, Dayton, Ohio. App. filed March 19, 1900. To take the place of a wiped joint, the cable ends are enclosed in a tubular casing, the ends of which are removable and contain suitable packing for sealing the joints.

651,163. SYSTEM OF DAY SIGNALING; B. A. Fiske, U. S. Navy. App. filed Aug. 21, 1896. (See Current News and Notes.)

651,167. MANUFACTURE OF CARBID OF CALCIUM; J. E. Hewes, Baltimore, Md. App. filed Oct. 6, 1899. (See Current News and Notes.)

651,179. GERM ARRESTER FOR MOUTHPIECES OF TELEPHONE SPEAKING TUBES, ETC.; C. J. Branch, Philadelphia, Pa. App. filed Nov. 21, 1899. A roll of paper is so mounted with respect to the mouthpiece that the strip may be drawn across the mouthpiece, to arrest any germs that might otherwise be deposited in the mouthpiece.

651,198. TELEPHONE TRANSMITTER; J. M. Moore, Chattem, Ill. App. filed Sept. 23, 1899. The electrodes are carbon balls arranged in carbon tubes and mounted in a peculiar way back of the diaphragm.

651,247. CHEMICAL ELECTRIC GENERATOR; H. K. Hess, Syracuse, N. Y. App. filed Aug. 31, 1896. Details.

651,248. CARBON AND GLOBE HOLDER FOR ARC LAMPS; A. Holliger, New York, N. Y. App. filed Aug. 2, 1899. Relates to the clamp for the lower carbon.

651,263. ELECTRIC RAILWAY RAIL BONDS; T. J. McTighe, New York, N. Y. App. filed Aug. 30, 1899. A rail bond composed of solid-shouldered terminals and a flexible connecting body made up of several members having their ends passing axially into or through the riveting studs of the terminals and rendered substantially homogeneous therewith by pressure.

651,271. ELECTRIC RAILROAD SWITCH; T. A. Rhodes, Jr., Langdon, D. C. App. filed Feb. 3, 1900. An electric motor is used to throw the switch tongue, current being switched into and out of the motor automatically by the car.

651,325. ELECTRIC BURGLAR ALARM SYSTEM; J. F. Dorsey, Washington, D. C. App. filed Oct. 7, 1899. A normally closed main line connecting an alarm station with a structure to be protected, circuit-closing devices operated by an increase in the current of the main line for closing separate or branch alarm circuits, and a resistance for controlling one of said circuit closers independently of the operation of the other.

651,326. ELECTRICAL HOSE SIGNALING APPARATUS; W. Fowler, Colorado Springs, Colo. App. filed March 13, 1899. This invention consists of the construction for completing the circuit through the coupling of the hose.

11,827. (REISSUE) MEANS FOR INDICATING MOVEMENT OF FLUID; O. Carpenter, Pawtucket, R. I. App. filed Nov. 6, 1899. An iron body is placed in the fluid passage, and a permanent magnet is located outside of the passage, but in such a position as to be influenced by the iron body. The movement of the fluid causes the body to move and thus move the magnet, which, in turn, closes an alarm circuit.